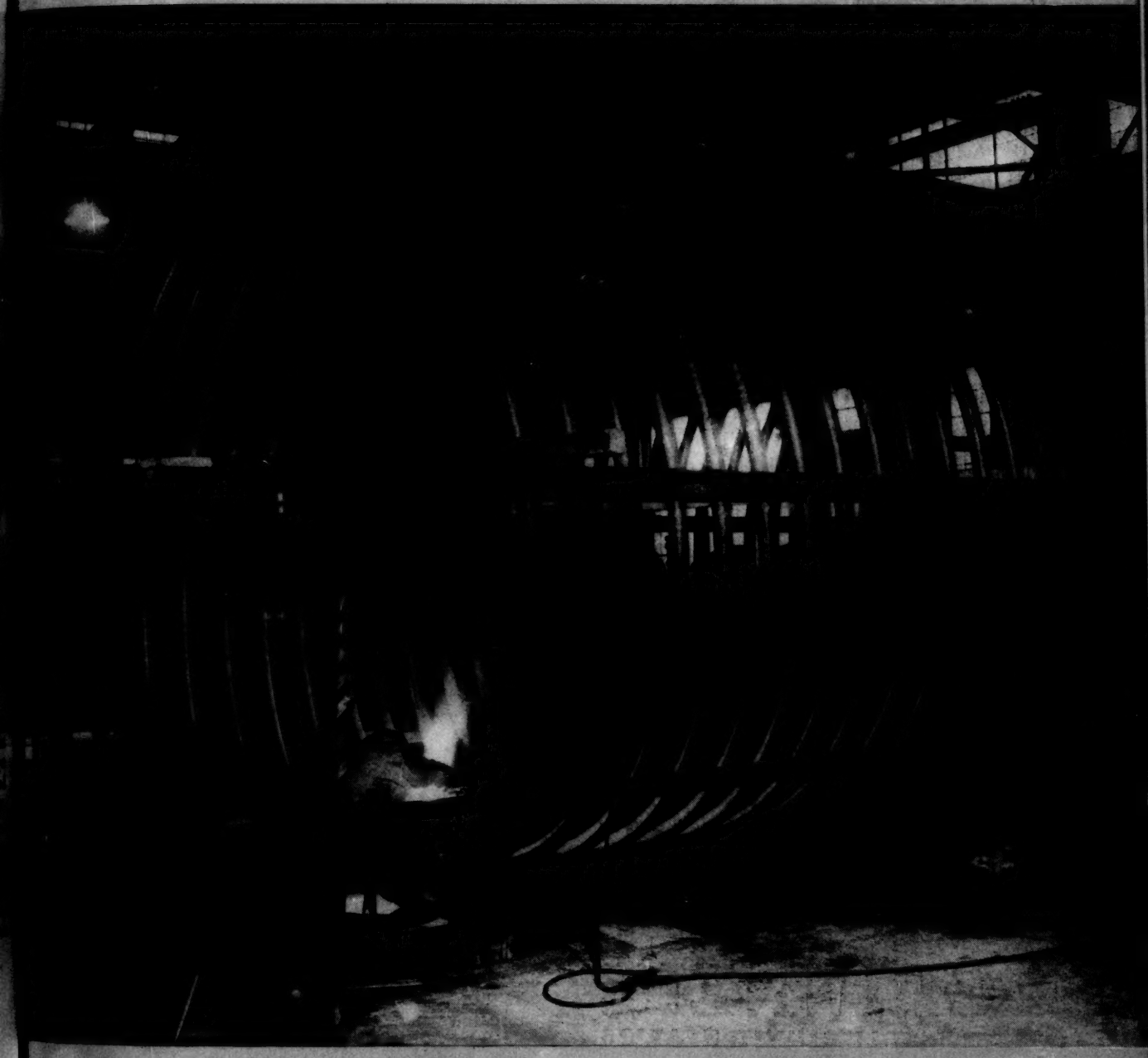
SEPTEMBER, 1952

# HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION



Welder joins sections of giant heating coil for process tank . . . See Page 3.

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Efficient Burning of Oil . page 87

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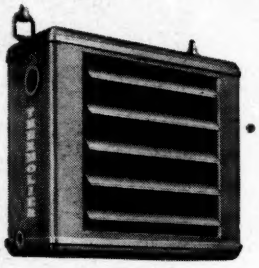
# FOR CLASSY SHOPS
# . . . OR BUSY PLANTS

The condensed table below is a quick guide to the selection of the correct Thermolier for specific conditions. The capacities, when motors are operating at normal speeds, are based on Standard Basis of Rating: 2 lb. steam pressure and 60° F entering air temperature.

Grinnell Thermoliers are tested and they are rated in strict accordance with rules of the Industrial Unit Heaters Association.

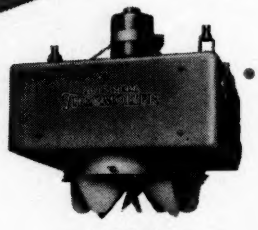
All Thermoliers can be operated at working steam pressures up to 125 psi and steam temp. up to 406° F.

## A MODEL AND SIZE FOR EVERY PURPOSE

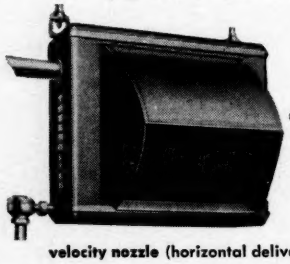


horizontal delivery

textile (horizontal delivery)



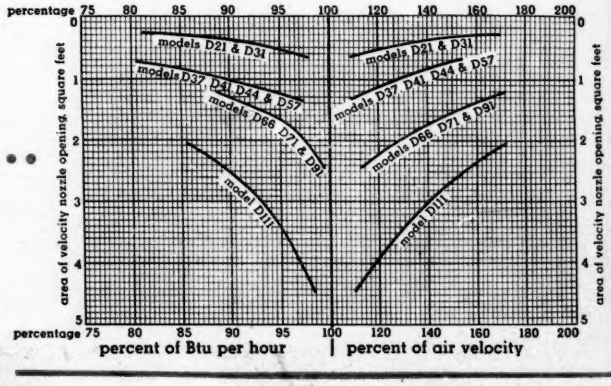
vertical delivery



velocity nozzle (horizontal delivery)

| model | total heat delivered, Btu per hr | sq ft edr (nominal) | air velocity at exit, louvers open, lin. ft. per min. |
|---|---|---|---|
| **horizontal delivery** | | | |
| D21 | 35,600 | 148 | 786 |
| D31 | 48,700 | 203 | 851 |
| D37 | 62,200 | 259 | 753 |
| D41 | 71,000 | 295 | 901 |
| D44 | 84,100 | 350 | 887 |
| D57 | 101,300 | 422 | 1016 |
| D66 | 128,700 | 536 | 779 |
| D71 | 151,700 | 632 | 977 |
| D91 | 196,000 | 817 | 985 |
| D111 | 275,300 | 1147 | 1048 |
| **Textile** | | | |
| TX70 | 69,800 | 291 | 826 |
| TX110 | 113,700 | 474 | 877 |
| **vertical delivery** | | | |
| VA1042 | 50,800 | 212 | 1399 |
| VA1045 | 73,600 | 307 | 1287 |
| VA1065 | 109,400 | 456 | 1354 |
| VA1075 | 145,600 | 607 | 1231 |
| VA1101 | 185,000 | 770 | 1495 |
| VA1111 | 257,000 | 1071 | 1631 |

*performance with velocity nozzle* ▶


percentage 75 80 85 90 95 100 120 140 160 180 200
models D21 & D31
models D37, D41, D44 & D57
models D66, D71 & D91
model D111
area of velocity nozzle opening square feet
0 1 2 3 4 5
percent of Btu per hour
percent of air velocity

# GRINNELL
## THERMOLIER UNIT HEATERS

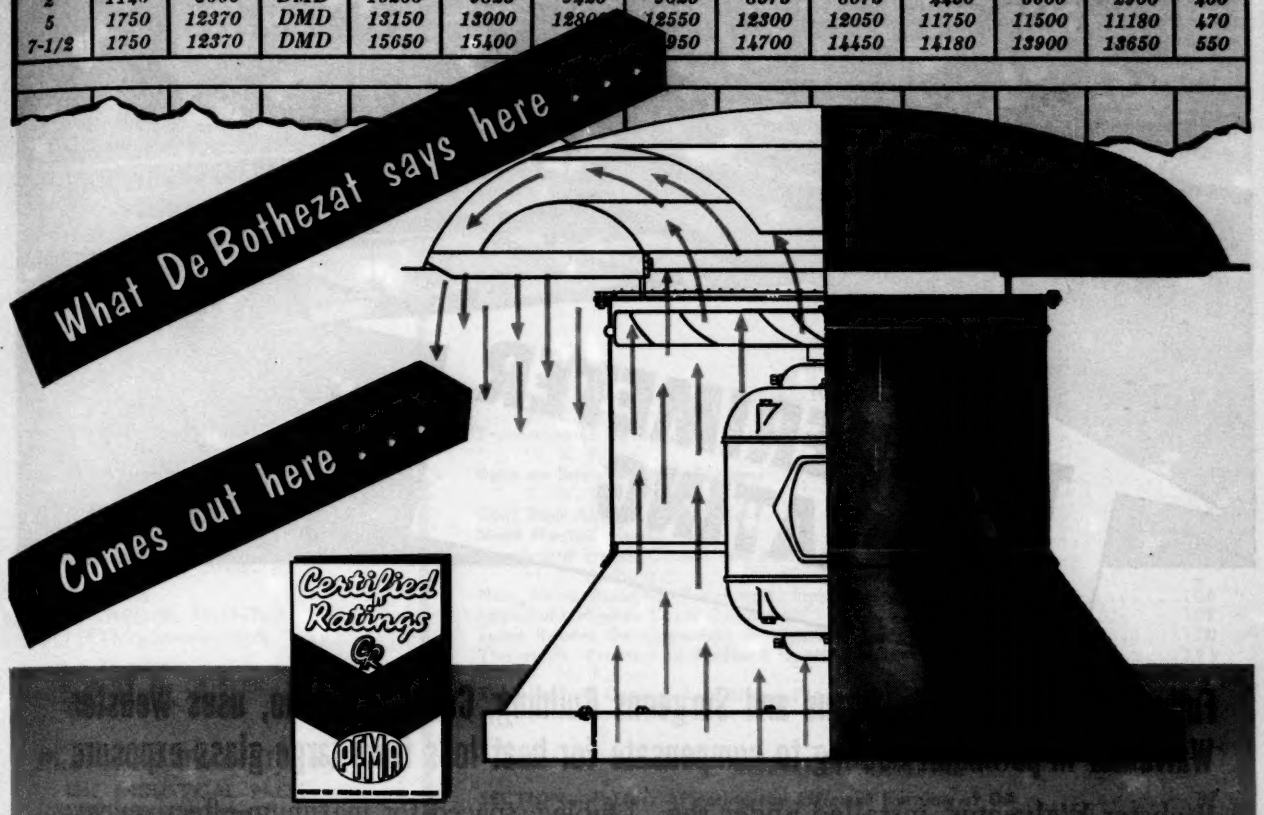
**CALL YOUR LOCAL GRINNELL DISTRIBUTOR**

**Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors**

**Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems**

# CERTIFIED CAPACITY RATINGS

| Motor HP | Fan RPM | Tip Speed | Drive | SP 0" | SP 1/8" | SP 1/4" | SP 3/8" | SP 1/2" | SP 5/8" | SP 3/4" | SP 7/8" | SP 1" | Net Wt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1140 | 8060 | DMD | 10200 | 9825 | 9425 | 9025 | 8575 | 8075 | 4450 | 3600 | 2900 | 400 |
| 5 | 1750 | 12370 | DMD | 13150 | 13000 | 1280 | 12550 | 12300 | 12050 | 11750 | 11500 | 11180 | 470 |
| 7-1/2 | 1750 | 12370 | DMD | 15650 | 15400 | | 950 | 14700 | 14450 | 14180 | 13900 | 13650 | 550 |

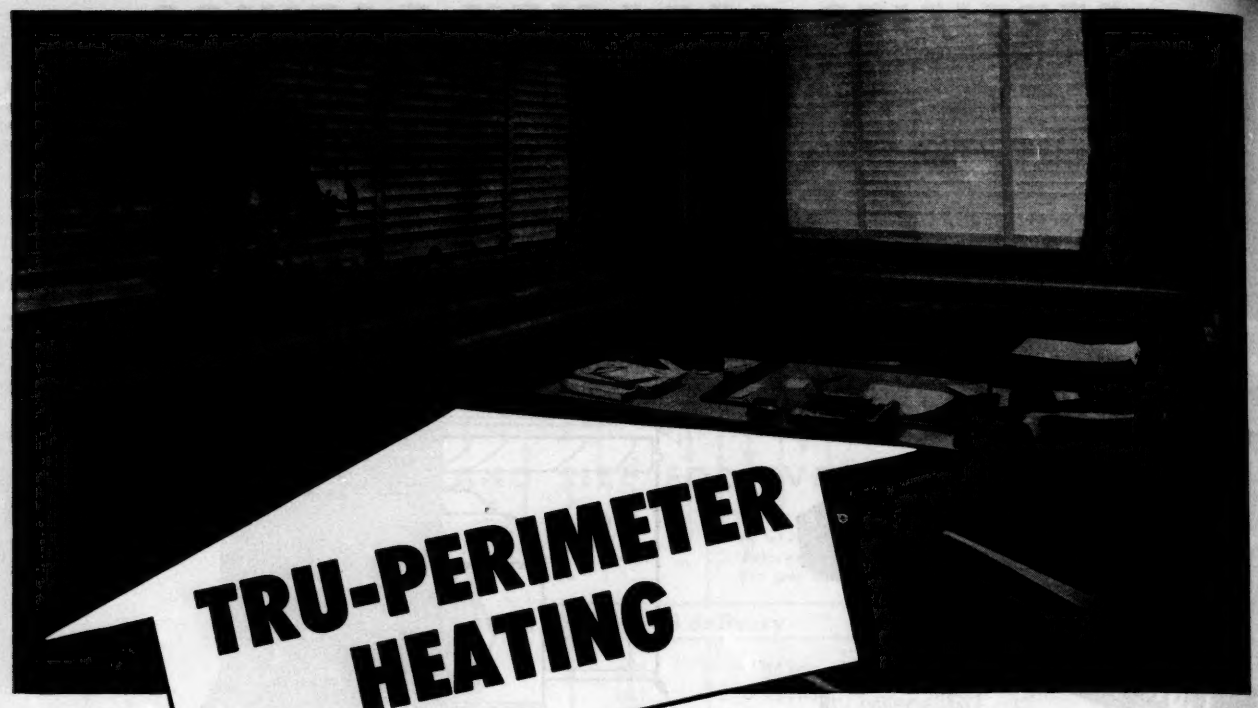



## POWER-FLOW ROOF VENTILATOR RATINGS ARE OUTPUT OF COMPLETE UNIT, WITH HEAD

## NOT OUTPUT OF FAN ALONE

# DeBothezat Fans

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS




## Fully air-conditioned Physicians and Surgeons Building, Columbus, Ohio, uses Webster Walvector in perimeter heating to compensate for heat loss from large glass exposure

Webster Walvector, installed under the continuous windows and extending only about 3 inches from the wall, spreads the heat from wall to wall in the Physicians and Surgeons Building. A continuous flow of hot water is circulated, heated sufficiently to completely offset the effect of the cold glass, thereby assuring comfort *everywhere*.

Top heating efficiency is assured through the use of sturdy aluminum fins on copper tubing, spaced for maximum effectiveness. Enclosures with integral grilles are sturdily built of amply heavy steel. Heating elements and enclosures are both mounted on a heavy gauge mounting angle, sealed against the wall with a continuous sponge rubber seal preventing any air flow in back of the mounting or enclosure.

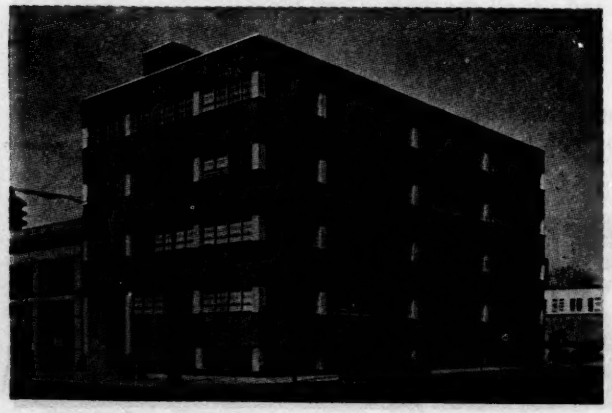
The list of advantages of Webster Perimeter Heating with Webster Walvector is a long one.

Complete technical data on Webster Walvector is available in Bulletin B-1551 and the experience of the 60-year old Webster organization is yours to call upon. Get in touch with your Webster Representative or write us.

Address Dept. HV-9

**WARREN WEBSTER & COMPANY**
Camden 5, N. J. Representatives in Principal U. S. Cities
*In Canada, Darling Brothers, Limited, Montreal*

**Physicians and Surgeons Building, Columbus, Ohio. Completed 1951, features Webster Walvector and complete air-conditioning. Architect: Tibbals, Crumley and Musson. Consulting Engineer: Robert S. Curl and Associates. Heating Contractor: The Huffman Wolfe Company.**



**Webster WALVECTOR**
REG. U. S. PAT. OFF.
**For Steam or Hot Water Heating**

# HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS



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***Published Monthly by***

THE INDUSTRIAL PRESS
148 Lafayette Street
New York 13, N. Y.

President
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***Subscription Rates***

Subscription rates in the United States and Canada, one year, $3; two years, $5; three years, $6; in all other countries, one year, $5; two years, $9. Single copies 30 cents. Entered as second-class matter, April 18, 1925, at the Post Office, New York, N. Y., under the act of March 3, 1879.

***Member***

Audit Bureau of Circulations
National Business Publications
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The Contents of HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and by Engineering Index, and are microfilmed by University Microfilms, Ann Arbor, Michigan.



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The Industrial Press

Also Publishers of
HEATING & PLUMBING EQUIPMENT NEWS
and technical books.


## THIS MONTH'S COVER

Twenty-foot lengths of extra-heavy, 3-inch, seamless iron pipe are welded together and rolled to form this giant half-completed heating coil for the inside of a processing tank at the Newark, N. J., plant of the Steel and Alloy Tank Company. The firm fabricates heavy pressure vessels and process equipment to meet severe conditions of pressure, temperature and corrosion. Welder is using General Electric coated electrodes.

# Washington News

LORING F. OVERMAN

FOR the Washington bureaucrat, these are indeed troublesome times.

On the one hand, aftermath of a steel strike and threat of a coal strike suggest to the bureaucratic mind any number of countermoves to force the recalcitrants into line.

On the other hand, word comes down from the top to "rock the boat just as little as possible" between now and election time. Of course, no one can put a finger on just where "the word" is coming from, but eavesdropping around the agencies leaves little doubt that most of the clubs are to be parked for the duration of the political campaign.

The word "parked" is used advisedly, for although the clubs may not swing for some little time, they are merely being racked for the moment to await the time when a little club-swinging can be considered safe. In other words, the controls procedures, even if laid aside temporarily, are to be kept polished and ready for instant use.

### Tip, Get Approval

Business, to take full advantage of the current circumstance, should not confuse political expediency with laxity of enforcement. Dope is that the defense agencies will do everything within the rules to "win friends and influence voters." Their purpose will be to please the vote-masses of employers and their employees, by making it as easy as possible to secure supplies, contracts, finances and other assistance.

But on the theory that those who break the rules will be in the minority, such violators will be considered by the agencies as fair prey for the ambitious youngsters on the legal staffs of enforcement divisions.

Best advice—whether one is after an extra allotment of controlled materials, a price concession, or a more liberal wage or salary deal—is to work hard and fast for approval by the appropriate agency. Folks within the agencies are likely to be in a more tractable mood than usual during the next few months. They're anxious to prove that they can be trusted to use discretion—but they want first to be asked.

### NPA Administrator Explains

The National Production Authority's insistence upon strict compliance with its plans for channeling steel during the period of shortage which is expected to follow the strike, was explained to 100 steel companies recently in a telegram signed by DPAdministrator Henry H. Fowler.

Mr. Fowler called attention to the fact that Amendment 1 to CMP Regulation 2, issued July 29, provided that from September 1 to December 31, 1952, inventories must be limited to a 30-day supply. Prior to the strike, a 45-day supply was permitted. He announced that NPA had a special emergency program to encourage voluntary conformity with the regulation, but that a special enforcement program has also been launched. He emphasized particularly that "compliance pertains not only to civilian producers but also to military producers."

The emergency program will include (1) cooperation from the Munitions Board and Armed Services; (2) presentation of the problem to all appropriate NPA industry advisory committee meetings, and (3) use of flying squads of NPA personnel from Washington to work with NPA field offices in investigating oversize inventories.

Although it is clear that the NPA chief means business when it comes to compliance, there are indications that any steel saved by such watchdogging will be made available to just about any "needy" steel user who may come, hat in hand, to present his claim of hardship and to provide convincing proof. After all, such is the purpose of the defense program—to provide materials where they are needed, to prevent waste by civilian or military users, to reward those who follow the rules, and to penalize those who do not play the game.

### Aid for the Home A-C Unit

Recent indications that the home air-conditioning unit is to become increasingly important in the industry's volume picture, make it advisable to properly evaluate the pre-election policies of the defense agencies. It must be conceded that there will not be enough steel to go around until production catches up with strikes losses. Meanwhile, military users are to get first go at available supplies, and the balance is to be distributed as widely as possible. Under those conditions, NPA can be expected to turn thumbs down on projects drawing heavily upon supplies, yet serving only a relatively few firms or individuals.

On the other hand, Congress, in amending the Defense Production Act, provided that credit controls must be relaxed if home building dropped below a rate of 1.2 million units a year for a three-month period. Building is below that level now, and it is expected that credit control on home mortgages will end by October 1.

Dropping of credit controls would scrap Regulation X, which calls for down payments ranging from 6% on a $7,000 house to 40% on homes that cost more than $25,000. The new law requires minimum down payments on all homes to drop to 5% when the rate of starts is below 1.2 million a year. Indications are that the Federal Reserve Board, which directs the operation of Regulation X, will drop all controls rather than work with the low down-payment rule.

Encouraging the construction of higher price housing should open a vast new market for home air conditioning. It cannot be anticipated, of course, that expiration of Regulation X will make available unlimited funds with low down-payments. Lenders have grown accustomed to the higher equities, and unless demand for mortgages should slacken, it could be that the ground rules on credit will not change greatly. Important point is the government's desire to encourage home construction at the 1.2 million level. Where there's a will, a way can usually be found.

# FOR THIS 90° BELOW COLD LABORATORY

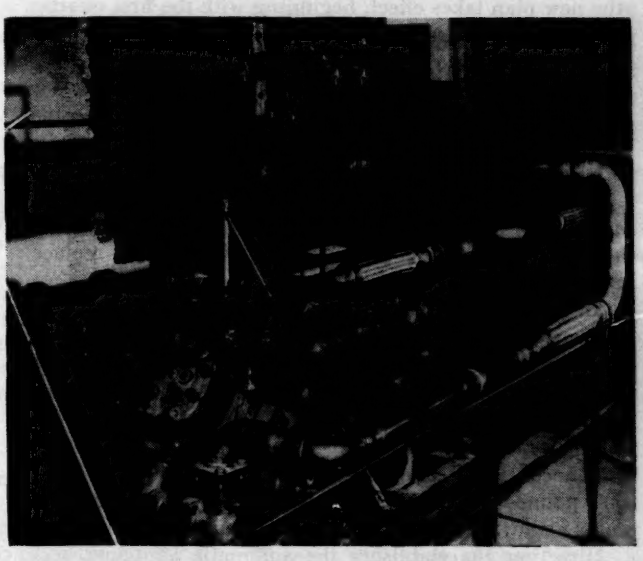
## PERFECTION STOVE COMPANY CHOOSES DEPENDABLE BRUNNER REFRIGERATION

In the new sub-zero testing laboratory of the Perfection Stove Company — man-made temperatures can go as low as –90° F. That's cold enough to change oils and diesel fuels to near solids, and cause many peculiarities to appear in metals.

To produce these blood-chilling temperatures, three Brunner compressors (two 40 HP, one 50 HP) are installed in a two-stage system, using F-22 refrigerant. The entire system is controlled by a single recording temperature controller — at a setting of plus or minus 1½° F.

The precision engineering and extreme attention to detail in the manufacture of Brunner refrigeration make Brunner the logical choice for the *tough* jobs — big or small. Let your Brunner representative show you why hundreds of contractors depend upon Brunner for top performance — minimum maintenance — maximum profits. Or write us — Dept. K-9.

Cold mist rises in laboratory as technicians brave temperatures more than 100° BELOW freezing!



One of the eight-cylinder Brunner compressors on the job at the Perfection Stove Co. laboratory.

This installation of Brunner Equipment installed by Ramsey-Bennett Co., Cleveland, Ohio.

FOR THE TOUGH JOBS — YOU CAN DEPEND UPON — BRUNNER SINCE 1906

**REFRIGERATION AND AIR CONDITIONING**

● For every air conditioning or refrigeration need . . . Brunner condensing units from ¼ HP to 100 HP — 69 air and water-cooled models. Self-contained Brunner packaged air conditioning units up to 10 HP.

### Construction Pattern

Heating, ventilating, air conditioning and plumbing businessmen interested in comparing their opportunities in housing markets with those in other fields will find a new NPA construction project yardstick helpful. The categories of industrial expansion projects now listed by NPA for 4th quarter allotments, in order of their importance, are as follows:

(1) Necessary for defense; critically important projects; highly important but not critical.

(2) Industrial new starts to meet expansion goals. Any construction for capacity above approved expansion goals will be treated as "other industrial" and will fall within category (3).

(3) Other Industrial; new starts involving hardship; new starts in areas of substantial unemployment; all other new starts in the order of essentiality.

In announcing its new policy, NPA explained that allotments of carbon, alloy or stainless steel cannot be made now to start any new projects in the 4th quarter of 1952 except those classified as necessary for defense.

Plans for the distribution of steel are being made with the understanding that the effects of the steel stoppage will be felt heavily for the next three to six months. Dr. John R. Steelman, acting head of the Office of Defense Mobilization, has estimated a total steel output of 90 million tons for 1952—the lowest level since 1949, and 14% below last year.

### New Self-Authorization Plan

A new self-authorization system is one of the post-election plans announced for the convenience of about half of the 22,000 manufacturers who must now apply to CMP for rations of steel, copper, and aluminum. When the new plan takes effect, beginning with the first quarter of 1953, only about 10,000 to 12,000 manufacturers will still be required to file CMP applications.

The new system, which will reduce paper work for manufacturers involved, is also to relieve pressure on the Washington office of NPA, which will lose 800 of its 4,100 employees in an appropriation slash.

The new system really involves two steps. Direction 17 and 18 to CMP Regulation 1 set up self-authorization and automatic allotment plans, respectively, and replace Direction 1 to CMP Reg. 1.

In Direction 17, NPA ordered continuation of the self-authorization system. This permits small users of metals to write their own priority tickets for specified minimum quantities of materials. With the exception of stainless steel, added for the first time, the amounts approved for self authorization remain the same as those previously announced: 25 tons of carbon steel, 1 ton of alloy steel, 500 pounds of nickel stainless steel, 10,000 pounds of copper and 20,000 pounds of aluminum.

Direction 18 establishes the automatic allotment system. It extends the self-authorization system to all those who were allotted in the third quarter of 1952 less than 500 tons of carbon steel, 90 tons of alloy steel, 10,000 pounds of nickel bearing stainless steel, 40,000 pounds of copper, and 60,000 pounds of aluminum. These amounts are large enough to relieve a large number of plants from filing CMP-4B applications.

Direction 18 fixes the foregoing as maximum amounts which a manufacturer may self-authorize. However, he will be permitted to self-authorize only a stated percentage of his past use of the metals. Following are the allowable percentages:

Carbon steel—100% of the first 60 tons he was allotted during the third period of 1952 plus 60% of any excess between 60 tons and 500 tons.

Alloy Steel—100% of the first 16 tons allotted during the third period plus 80% of amounts between 16 tons and 90 tons.

Nickel stainless steel—100% of the first 500 pounds allocated in the third quarter, plus 80% of amounts between 500 pounds and 10,000 pounds.

Copper and aluminum—100% of total amounts received during the third quarter provided these amounts do not exceed 40,000 pounds of copper and 60,000 pounds of aluminum.

NPA notes that allowances of steel under the "automatic" method are somewhat more generous than those which manufacturers would receive if they continued to apply directly to NPA for first quarter allotments. This generosity is to be interpreted as a bonus for using the new self-authorization machinery, instead of burdening the curtailed NPA staff with individual applications.

The National Production Authority has emphasized that only those manufacturers who have received official CMP 4-B allotments for the third quarter of 1952 are eligible to use the automatic allotment procedure. Also, a manufacturer who uses any of the three allotment methods—CMP 4-B application, self authorization as a small user, or automatic allocation—must use the same form for all of his metals requirements.

A third NPA order, Amendment 2 to Direction 1 of CMP Reg. 1, fixes December 31, 1952, as a cutoff date for the multi-level self-authorization procedure now in use. The new allotment system will become effective January 1, 1953.

### Washington Miscellany

*Expansion Goals* have been announced for two items of interest to H&V readers. Goal for regenerative air preheaters has been set at 384 units annually by January 1, 1954. This represents an increase of 168 units over the annual capacity of 216 units on January 1, 1951.

Tubular Heat Exchanger capacity of 58.5 million sq ft —an expansion of 20 million sq ft over January 1, 1951—is the goal for January 1, 1954.

*Basic Refining Facilities* now planned for construction by the petroleum industry total 1,215,000 barrels a day, the Petroleum Administration for Defense has reported. By January 1, 1953, PAD estimated, facilities with an aggregate capacity of 528,600 barrels a day will have been completed. The total is expected to rise to 742,460 barrels daily by July 1, 1953, and to 1,078,100 by January 1, 1954.

*Small Firms Exempt.* Manufacturers doing less than $25,000 in business annually are exempt from price control, OPS has announced. Congress, in extending the Defense Production Act, freed from wage controls any firm employing fewer than eight workers.

### New Atom Plant

Air conditioning people may expect to take an active part in construction of a new gaseous diffusion plant for the production of uranium 235, to be built in Pike County, Ohio, 22 miles of Portsmouth in the Ohio River Valley. Cost, $1.2 billion.

# AVAILABLE NOW!

## The first motion picture on SNOW MELTING SYSTEMS

Now, for the first time, you can actually see these modern snow removal systems in operation. In the last few years, a great amount of material has been written and published on snow melting systems, but our new film, "A Winter Wonder," takes you "on location" and shows you how Byers Snow Melting Systems came through recent winter snowfalls in a wide variety of applications.

This professionally-produced film reviews the entire snow melting subject from installation to performance. You'll see how coils of Byers Wrought Iron pipe, embedded in concrete, and carrying hot water-anti-freeze solution, brought hazard-free surfaces to sidewalks and driveways of private homes, commercial buildings, industrial plants, service stations, and many others. In addition to these interesting scenes of "snow melting at work," you'll watch actual operation of installing, welding, and covering prefabricated grids of genuine wrought iron pipe.

Based on the greatest pool of engineering experience on snow melting in existence today, "A Winter Wonder" has been developed as a service to the designer, fabricator, contractor and building engineer. If you share today's widespread interest in snow melting systems, you'll find the practical and factual material in this film both interesting and helpful.

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**WROUGHT IRON**

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ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

# *Look for Economy*
## WHEN YOU BUY HEATING PUMPS

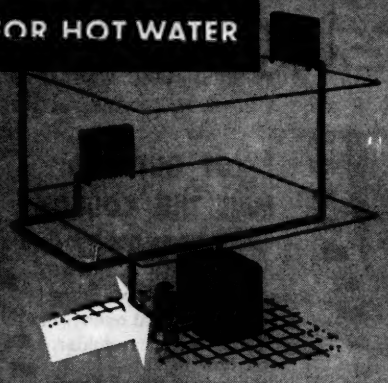
# WHEELER-ECONOMY HEATING PUMPS
## with Better-Than-Ever Engineering and Quality Control

With the consolidation of Economy Pumps, Inc. and C. H. Wheeler Manufacturing Company, the heating pumps you have always bought as "the best in the field" will now be sold as WHEELER-ECONOMY HEATING PUMPS. Representatives are being appointed in key areas to give you good service with a time-honored line of heating pumps that is now *better than ever.*

The Wheeler-Economy line of heating pumps has undergone a complete engineering check-up and reanalysis from the castings out. Many refinements have been made and a new face-lifting has been effected...

## TYPES FOR EVERY BASIC HEATING PROBLEM

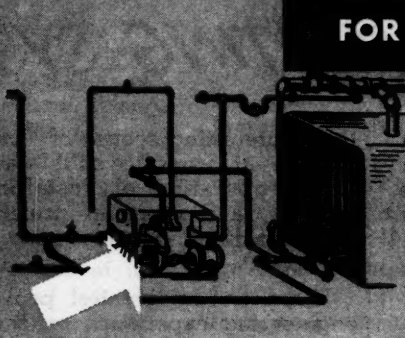
FOR HOT WATER



### HOT WATER CIRCULATION

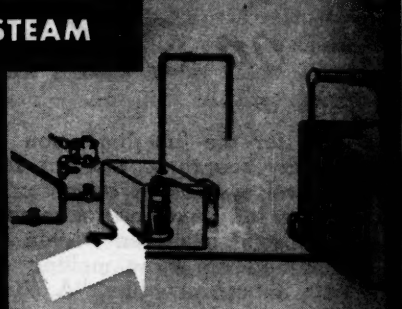
Wheeler-Economy Pumps deliver hot water to radiators quickly and return warm water to boiler with minimum heat loss.

FOR STEAM



### STEAM VACUUM

The Wheeler-Economy Vacuum Producer is the most efficient design ever devised for removing air and water from condensate return lines.



### RETURN CONDENSATION

Wheeler-Economy Pumps combine outstanding performance with low power cost in a compact dependable design.

## WHEELER-ECONOMY HOT WATER C

**Type SCV**—Vertical direct connected centrifugal pump. Sizes 1" to 3". Capacities to 500 GPM. Various RPM speeds 1150 to 3450. Heads to 225'.

**Type SCC**—Close coupled vertical or horizontal mounted. Sizes 1½" and 2". Capacities to 100 GPM. 3450 RPM. Heads to 120'.

## WHEELER-ECONOMY VACUUM PUMPS

**Type VV—Vertical Vacuum Pumps**—Suitable for use on all ordinary jobs operating between 3 and 12 inches of vacuum. Made for all discharge pressures up to 150 lb. per sq.in. Capacity sq.ft. E.D.R. 2500 to 15,000. Single and duplex units.

**Special Capacities**—VVS and VVSD single and duplex units recommended wherever capacity of system or air leakage is greater than ordinary. Also where lifts or pockets in the returns necessitate carrying higher vacuum. (Example: 10 to 16 inches.)

**Type SVA—Horizontal Vacuum Pumps**—For ordinary jobs operating between 3 and 12 inches of vacuum. Discharge pressures up to 150 lb. per sq.in. Capacity sq.ft. E.D.R. 20,000 to 100,000. Single and duplex units.

**Special Capacities**—Styles SVS single unit and DVS Duplex Unit, recommended where air capacity or air leakage in the system is greater than ordinary. Also where lifts or pockets in return require the carrying of higher vacuum—example 10 to 16 inches.

## WHEELER-ECONOMY RETURN CONDENSATION PUMPS

**Type E**—Operate at 1750 RPM or for 50 cycle current at 1440 RPM. The best pump where extremely quiet operation is desired. Single and duplex units. Capacity sq.ft. direct C.I. radiation or equivalent: 1000 to 65,000.

**Type EC**—Available for the same or higher pressure than handled by Type E pumps. Operate at 3450 RPM. Units for 50 cycle current operate at 2880 RPM. Capacity sq.ft. direct C.I. radiation or equivalent 1000 to 65,000. Single and duplex units.

**Vertical Underground Pump**—Used where returns are below floor level or otherwise too low for horizontal pumps. Cast Iron tank can be installed flush with floor. No pit required for pump. Low and medium pressure units equipped with single stage pumps of vertical design. For higher pressure units a multistage pump of special design is used. Capacity in sq.ft. direct C.I. radiation or equivalent 2000 to 50,000. Single and duplex units.

**Type S—Condensation Pump with Steel Receiver**—An "Economy" installation where service is not severe and heavy construction cast iron tanks are not required. Where steel receiver is satisfactory and low cost is of primary importance Type S is recommended. However, these low cost models are the equal of the top grade in many competitive lines. Single or duplex units.

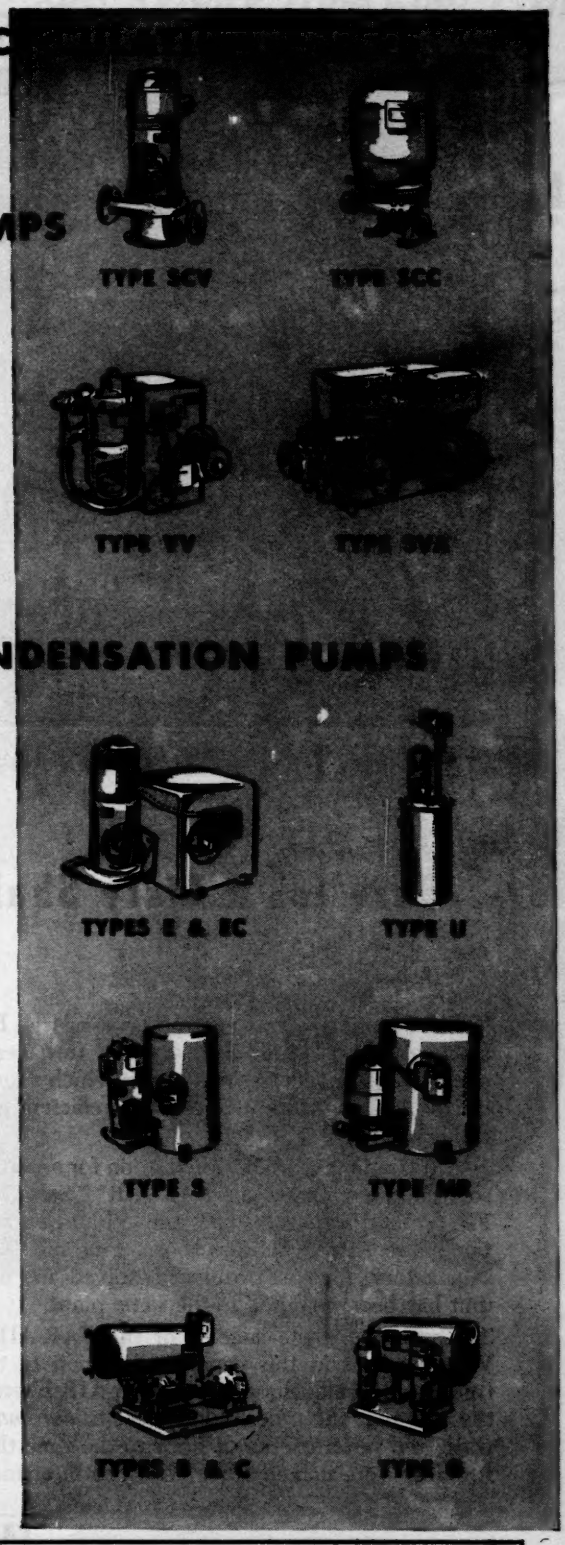
**Type MR**—Lightweight Pump for low pressure steam heating systems. Priced to meet competition . . . with no compromise in workmanship and materials. Capacities up to 65,000 sq.ft. E.D.R. Single and Duplex Units.

**Types B and C—Horizontal Return Condensation Pumps**—Type B multi-stage pump for pressures up to 150 lbs. 1750 RPM. Quiet operation. Capacities in sq.ft. direct C.I. radiation equivalent to 6000 to 65,000.

Type C multi-stage pump for pressures up to 175 lbs. 3600 RPM 60 cycle. Identical to type B except for higher speed operation. Capacities in sq.ft. direct C.I. radiation equivalent to 6000 to 65,000.

**Type G—Horizontal Return Condensation Pump**—Type G single suction, single stage designed for medium and high pressures at motor speeds 1800 to 3450 RPM. Receivers of all three types, "B", "C" and "G" are welded steel plate unless otherwise ordered.

***All Wheeler-Economy Heating Pumps are tested before shipment and guaranteed for workmanship and materials.***

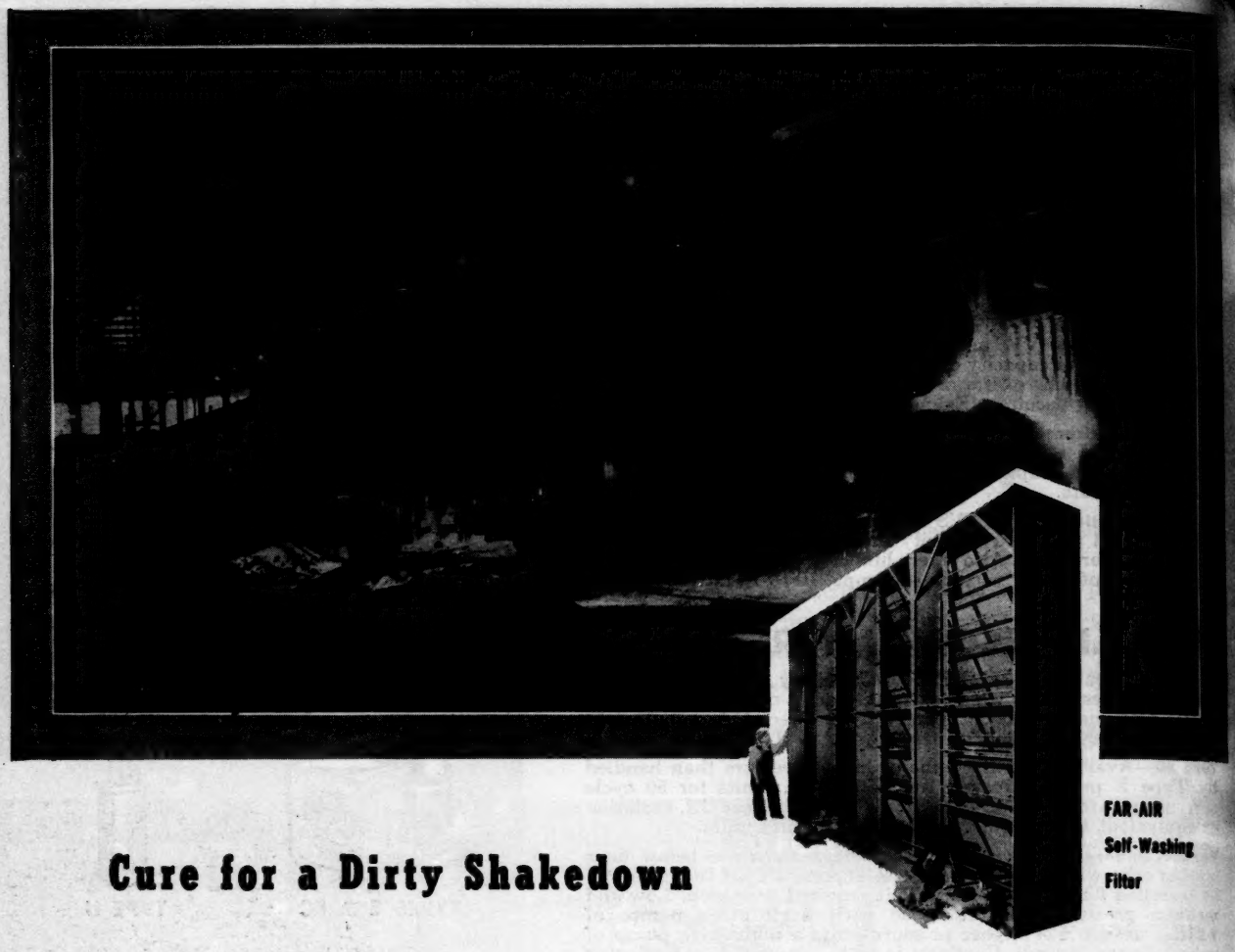



**SOME TERRITORIES STILL AVAILABLE FOR REPRESENTATIVES WHO QUALIFY**

**Over 15 million dollars' worth of these pumps are in use throughout the United States**

126

# WHEELER-ECONOMY PUMPS



FAR-AIR Self-Washing Filter

# Cure for a Dirty Shakedown

Twice each day it was necessary for a large Eastern steel producer* to shakedown his furnaces. This caused high concentrations of dirt which resulted in severe air filter maintenance and inefficient air conditioning.

FARR Company, when called upon for a permanent solution, recommended a FAR-AIR** Self-Washing Filter. This proposal was approved and an installation made. After two years of use, the results are very satisfactory; the dirt problem is solved and another unit has been installed in the same plant.

The reason for the success of the FAR-AIR Self-Washing unit in this case (in addition to the extremely high efficiency of the FAR-AIR filters) was the fact that the unit could be set to *automatically* wash and re-oil itself just prior to the time that the furnaces were shaken down. Thus, maintenance was virtually eliminated and the filters were always at peak efficiency.

FAR-AIR Self-Washing Filters can be furnished to handle any CFM requirement. If you have an air filtration problem, Farr engineers will be glad to help you find the proper solution. There is a FAR-AIR product to meet most filtering needs. Write for complete information to Farr Company, P.O. Box 10187 Airport Station, Los Angeles 45, California.

Other FAR-AIR products include standard commercial and industrial panel filters, marine filters, rotary coolers, grease eliminators, filter maintenance equipment. Also, special filters for special applications.

*Name furnished on request.

**Trade Mark Registered

**FAR-AIR FILTERS**

*"Better by Farr"*

**FARR COMPANY** *Manufacturing Engineers*

Los Angeles • Chicago • New York

M'f'd under license by Control Equipment Co., Ltd. Montreal, Canada

"Buffalo"

*Tips on Getting the Best Service from your Fans*

# PICK THE FAN TO SUIT THE PLAN!

## THE AXIAL FLOW FAN
### Forms a Straight Duct Suction

For ventilating and Air Condition service, where your piping will be straight, this Axial Flow Fan is ideal. Fitting in as a section of pipe, it requires little more cubic space than does the pipe. "Buffalo" Fans like the Type "B" Vaneaxial above, are also relatively light, which reduces installation cost. Also, this type of fan is unusually efficient in these straight duct runs. Another advantage in "Buffalo" Axial Flows is their limit-load characteristic —you cannot overload them, regardless of system pressure.

*For Performance Curve*

and other useful information on "Buffalo" Axial Flow Fans, write today for Engineering Bulletin 3533-C.

*The Centrifugal Fan,*

like this "Buffalo" Limit-Load Fan, forms a built-in 90-deg. elbow. If your system is to have many curved connections, consider this type of fan. Details are in Bulletin 3737. *Write for your copy.*

"Buffalo" FIRST FOR FANS

**BUFFALO FORGE COMPANY**

480 BROADWAY BUFFALO, NEW YORK

*PUBLISHERS OF "FAN ENGINEERING" HANDBOOK*

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING

FORCED DRAFT COOLING HEATING PRESSURE BLOWING

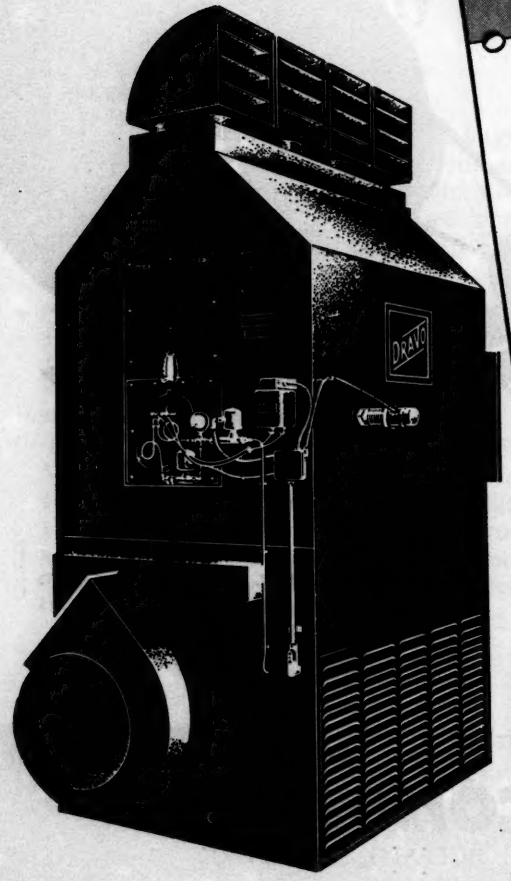
# *Facts* AVAILABLE TO YOU ABOUT...

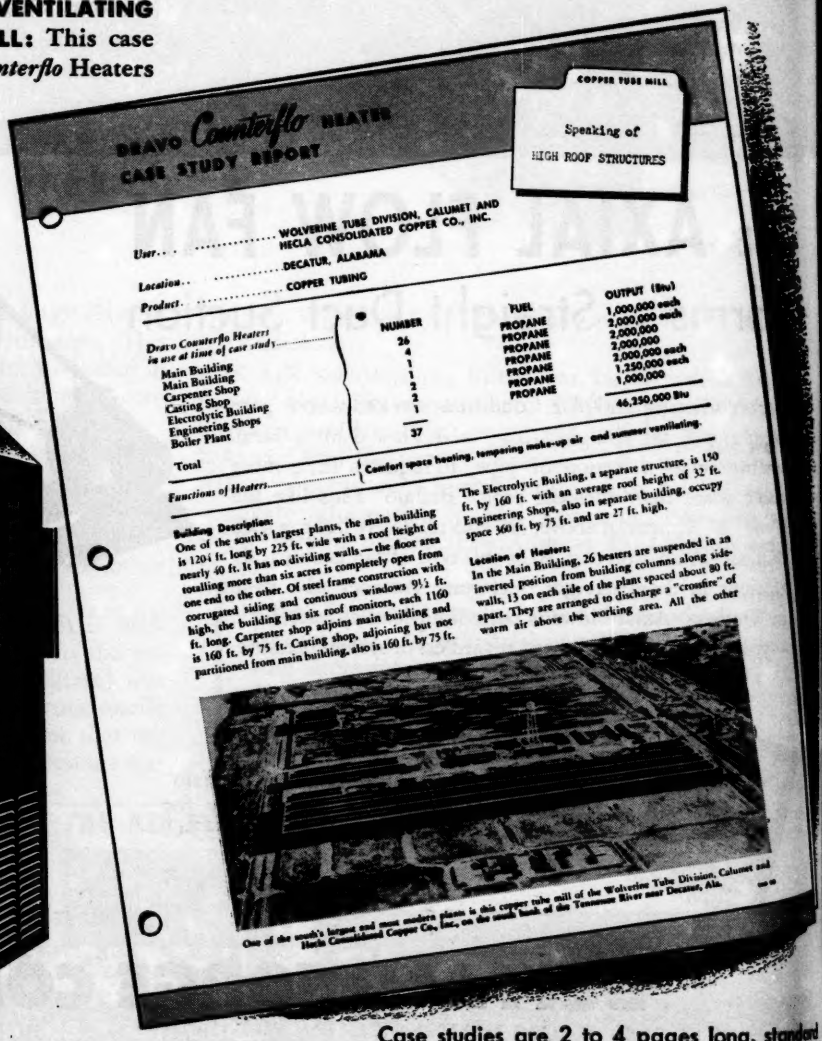
## IN THESE *FREE* CASE STUDIES OF ACTUAL INSTALLATIONS...

Complete information—names, diagrams and photographs, along with the results obtained by using Dravo Heaters—is provided in detailed case studies, covering a wide variety of heating problems in many types of industrial buildings. If you buy, specify or recommend space heating equipment, these case studies will be of value to you.

### *FOR EXAMPLE...*

**COMPLETE HEATING AND VENTILATING FOR A SIX-ACRE TUBE MILL:** This case study tells how 37 Dravo *Counterflo* Heaters provide comfort heat in winter, summertime ventilation and fresh, outside air to replace foul air exhausted by ventilators over furnaces. At this modern plant, heat is delivered at the working level and kept there; the Dravo recirculation system keeps roof heat losses low. Heaters are automatic in operation; maintenance costs are low. Get this case study . . . and others on different problems . . . FREE!



DRAVO *Counterflo* HEATER
CASE STUDY REPORT

COPPER TUBE MILL

Speaking of
HIGH ROOF STRUCTURES

*User*..... WOLVERINE TUBE DIVISION, CALUMET AND HECLA CONSOLIDATED COPPER CO., INC.

*Location*..... DECATUR, ALABAMA

*Product*..... COPPER TUBING

| *Dravo Counterflo Heaters in use at time of case study* | NUMBER | FUEL | OUTPUT (Btu) |
|---|---|---|---|
| Main Building | 26 | PROPANE | 1,000,000 each |
| Main Building | 4 | PROPANE | 2,000,000 each |
| Carpenter Shop | 1 | PROPANE | 2,000,000 |
| Casting Shop | 1 | PROPANE | 2,000,000 |
| Electrolytic Building | 2 | PROPANE | 2,000,000 each |
| Engineering Shops | 2 | PROPANE | 1,250,000 each |
| Boiler Plant | 1 | PROPANE | 1,000,000 |
| Total | 37 | | 46,250,000 Btu |

*Functions of Heaters*..... Comfort space heating, tempering make-up air and summer ventilating.

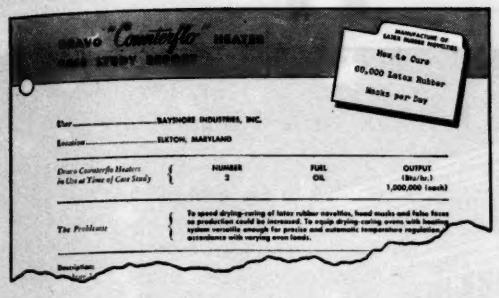
**Building Description:**
One of the south's largest plants, the main building is 1204 ft. long by 225 ft. wide with a roof height of nearly 40 ft. It has no dividing walls—the floor area totalling more than six acres is completely open from one end to the other. Of steel frame construction with corrugated siding and continuous windows 9½ ft. high, the building has six roof monitors, each 1160 ft. long. Carpenter shop adjoins main building and is 160 ft. by 75 ft. Casting shop, adjoining but not partitioned from main building, also is 160 ft. by 75 ft. The Electrolytic Building, a separate structure, is 150 ft. by 160 ft. with an average roof height of 32 ft. Engineering Shops, also in separate building, occupy space 360 ft. by 75 ft. and are 27 ft. high.

**Location of Heaters:**
In the Main Building, 26 heaters are suspended in an inverted position from building columns along side-walls, 13 on each side of the plant spaced about 80 ft. apart. They are arranged to discharge a "crossfire" of warm air above the working area. All the other

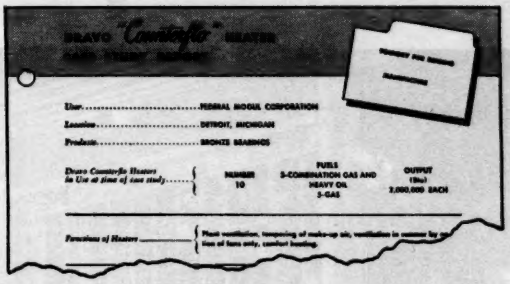
One of the south's largest and most modern plants is this copper tube mill of the Wolverine Tube Division, Calumet and Hecla Consolidated Copper Co., Inc., on the south bank of the Tennessee River near Decatur, Ala.

Case studies are 2 to 4 pages long, standard 8½" x 11" size for easy filing, and punched for 3-ring binder.

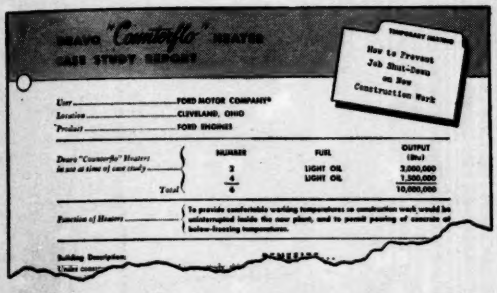
# ..VERSATILE DRAVO *Counterflo* HEATERS



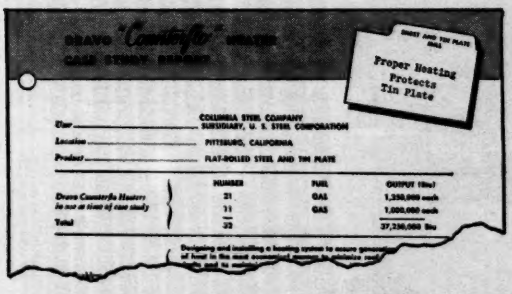

**PROCESS DRYING AND HEAT CURING:** In industrial production of products such as plastics, wood, rubber, paper, fibers, and ceramics, Dravo Heaters have often increased production due to faster, more efficient drying and curing.


DRAVO "Counterflo" HEATER
CASE STUDY REPORT
User FEDERAL MOGUL CORPORATION
Location DETROIT, MICHIGAN
Products BRONZE BEARINGS
Dravo Counterflo Heaters In Use at time of case study
NUMBER 10
FUELS 3-COMBINATION GAS AND HEAVY OIL 3-GAS
OUTPUT (Btu) 2,000,000 EACH
Functions of Heaters

**TEMPERING OF MAKE-UP AIR:** Where the necessary removal of noxious fumes or harmful dusts from the air makes comfort heating for workers difficult, Dravo Heaters warm replacement air and keep temperatures constant.




**TEMPORARY HEATING:** Dravo Heaters provide comfort heating and increase worker-efficiency during building construction and can keep ground temperature above freezing for pouring and setting concrete floors during cold weather.


DRAVO "Counterflo" HEATER
CASE STUDY REPORT
Proper Heating Protects Tin Plate
User COLUMBIA STEEL COMPANY SUBSIDIARY, U. S. STEEL CORPORATION
Location PITTSBURG, CALIFORNIA
Product FLAT-ROLLED STEEL AND TIN PLATE
Dravo Counterflo Heaters In use at time of case study
NUMBER
FUEL
OUTPUT (Btu)
21 GAS 1,250,000 each
11 GAS 1,000,000 each
Total 32 37,250,000 Btu

**COMFORT HEATING LARGE BUILDING AREAS:** Garages, diesel repair shops, auditoriums, etc. with large open spaces are heated comfortably and easily . . . Dravo Heaters provide quick, automatically controlled, low-cost heat.

## DRAVO HEATERS OFFER YOU:

- **LOW INITIAL COST**—Users report 30% to 60% savings over "wet-type" systems.
- **EASY INSTALLATION**—Need only fuel, exhaust and electrical connections . . . no ductwork.
- **LOW OPERATING COST**—Direct-fired . . . burn gas or oil . . . readily converted . . . minimum efficiency 80%.
- **AUTOMATIC OPERATION**—on-off or modulating controls . . . no constant attention required.
- **LONG SERVICE LIFE, LOW MAINTENANCE**—Stainless steel combustion chamber eliminates refractory lining.
- **SAFETY**—Approved by American Gas Association, listed by Underwriters' Laboratories, Inc.; Dravo standardized safety control circuit accepted by Factory Mutual Engineering Division.
- **MOBILITY**—Can be moved to any location.
- **FLEXIBILITY**—When floor space is limited, can be wall-hung or suspended from trusses in any position.

**"CASE STUDIES INVALUABLE,"** writes a Heating Engineer. "They are informative and highly useful to me."

*Send this Coupon Today!*

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☐ Stores, schools and auditoriums. ☐ Tempering make-up air.
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☐ Process drying and heat curing. ☐ Please have a representative call.

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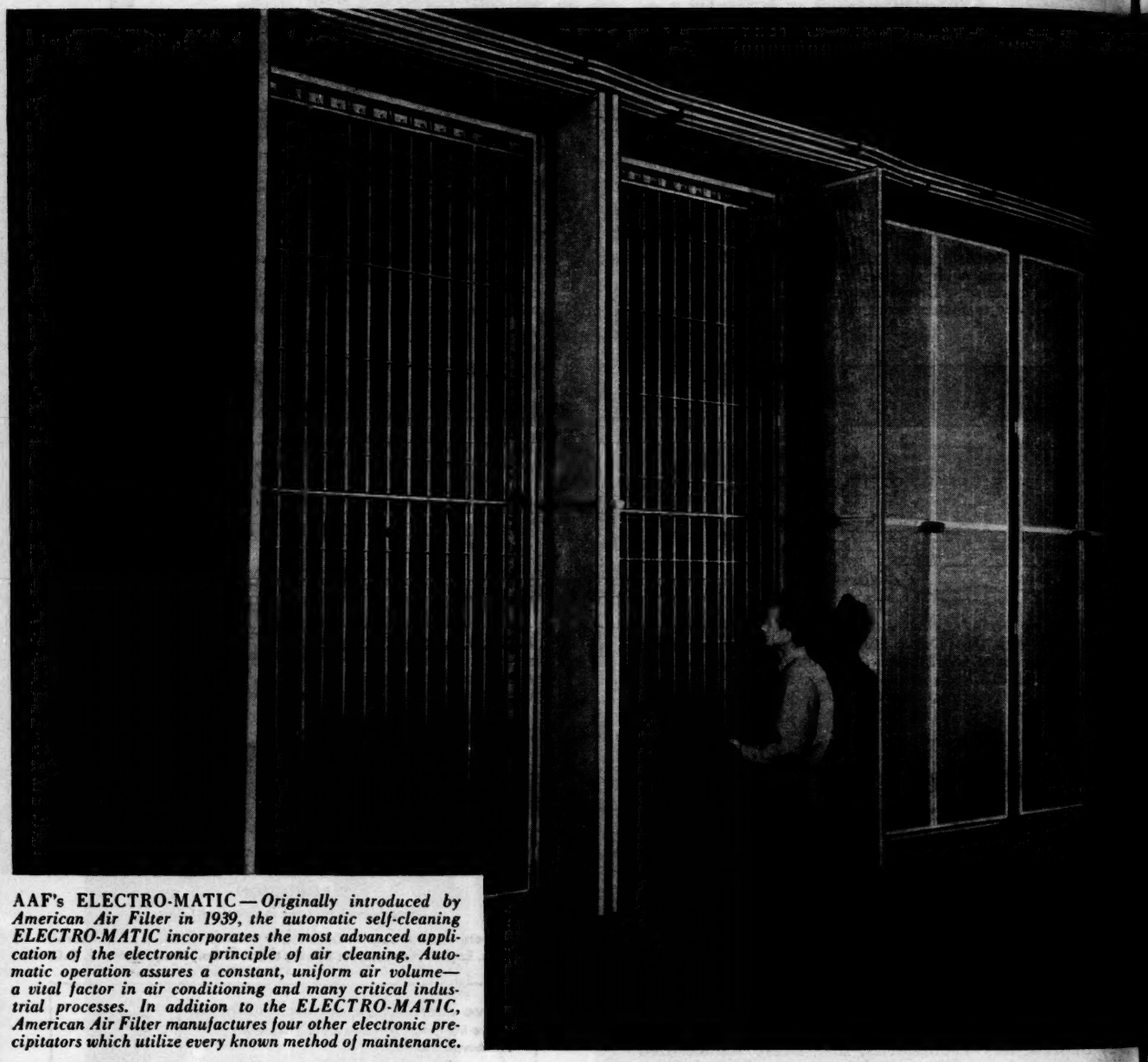
Company_____ Title_____

Address_____

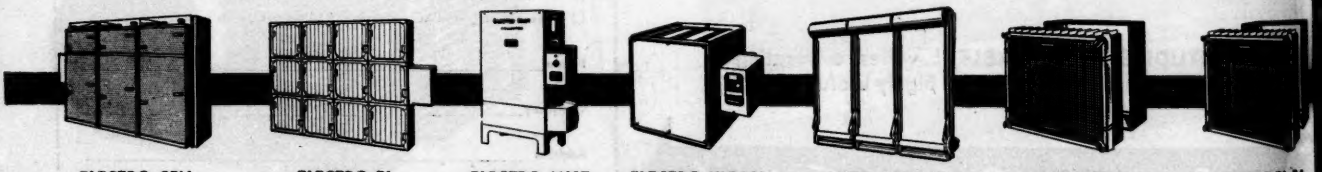
City_____ Zone_____ State_____

# Why five types of



AAF's ELECTRO-MATIC — *Originally introduced by American Air Filter in 1939, the automatic self-cleaning ELECTRO-MATIC incorporates the most advanced application of the electronic principle of air cleaning. Automatic operation assures a constant, uniform air volume— a vital factor in air conditioning and many critical industrial processes. In addition to the ELECTRO-MATIC, American Air Filter manufactures four other electronic precipitators which utilize every known method of maintenance.*

## a single source for all air cleaning equipment . . . . . .



ELECTRO-CELL · ELECTRO-PL · ELECTRO-MIST · ELECTRO-KLEAN · AUTO-AIRMAT · AIRMAT PL-24 (with felt) · AIRMAT PL-24

# electronic air cleaners?

**AAF's** five distinct types of electronic precipitators have highly individual characteristics . . . for a reason! As part of AAF's complete line of air cleaning equipment, they were developed to meet complex and distinctly different air cleaning requirements for fine particle size in both commercial and industrial application. As a result, the engineer is given the opportunity to *select* from a wide range of performance characteristics, rather than to be restricted to one type of electronic precipitator and try to make it fit the job.

AAF's group of five electronic precipitators offer these selective features:

- Different Efficiency Ratios
- Several Methods of Maintenance
- Variety of Space Requirements
- Wide range of sizes and air volumes
- Practical and realistic range of initial costs

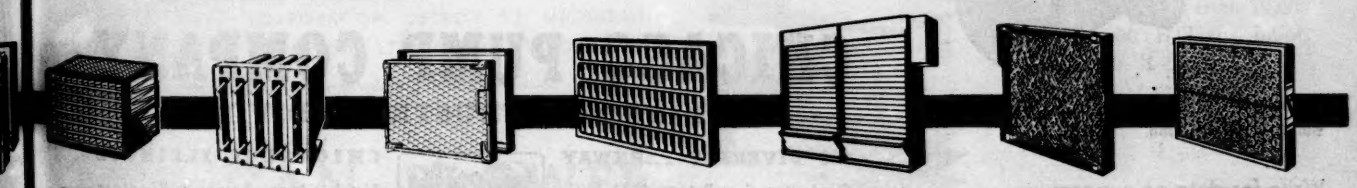
In addition to manufacturing the only complete line of air cleaning products, AAF's engineering staff is recognized as the leading authority in this field. The specialized knowledge of these men can save you time, effort and expense. If you have a dust problem, let us help you solve it.

Complete engineering data on all AAF equipment is available. Contact your nearest AAF representative, or write American Air Filter Company, Inc., 294 Central Avenue, Louisville 8, Ky.

**American Air Filter**
**COMPANY, INC.**

**294 Central Avenue, Louisville 8, Ky.**

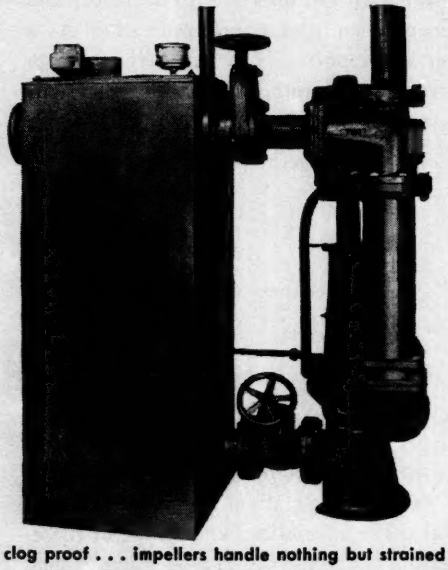
**American Air Filter of Canada, Ltd., Montreal, P. Q.**
**Pacific Division Office, San Francisco, California**



# For Every Service Within the Building

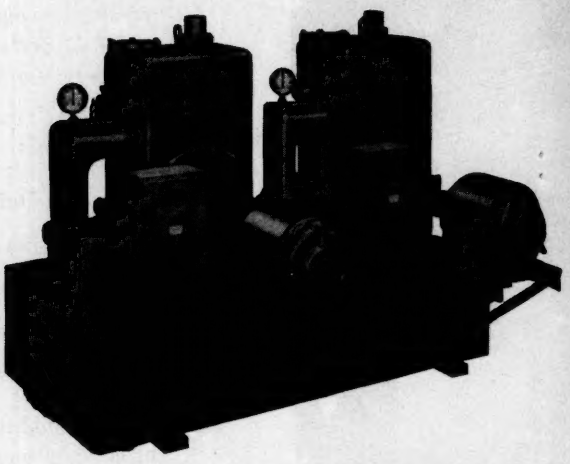
# *Specify* Chicago PUMPS

## FLUSH-KLEEN Sewage Ejector



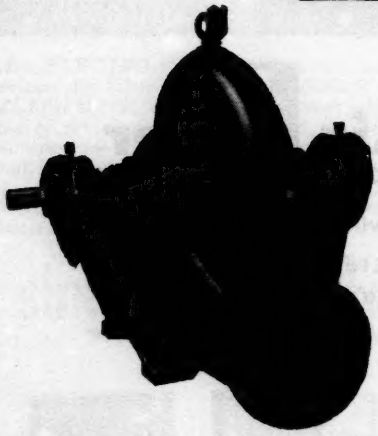
Absolutely clog proof . . . impellers handle nothing but strained sewage, minimizing wear and maintaining pump balance. Specially designed for plumbing systems in buildings where maximum flow is not more than 50 GPM. A second unit can be added any time to make duplex installation.

## CONDO-VAC Return Line Vacuum and Boiler Feed Pump



No vacuum on stuffing boxes, ample clearance in rotating member. It costs less to operate a "Condo-Vac." "Condo-Vac" reduces corrosion in piping and boiler to minimum—because pump does not take in air from atmosphere and entirely eliminates all air coming back from system. "Condo-Vac" is quiet, has a low inlet, entirely automatic, easy to maintain.

## CHICAGO CIRCULATING PUMPS



*Type "D"—For "Heavy Duty" Building Application.*

The complete line of "Chicago" Pumps are built to give you exactly the type of service you want . . . efficiency . . . convenience . . . minimum operating and repair expense. Construction leaders everywhere endorse these "Chicago" pumps.

*Type "N"—For "Light Duty" Building Application.*

*Write for data on our complete line of equipment.*

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**BUILDING and INDUSTRIAL DIVISION**

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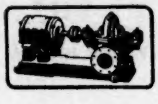
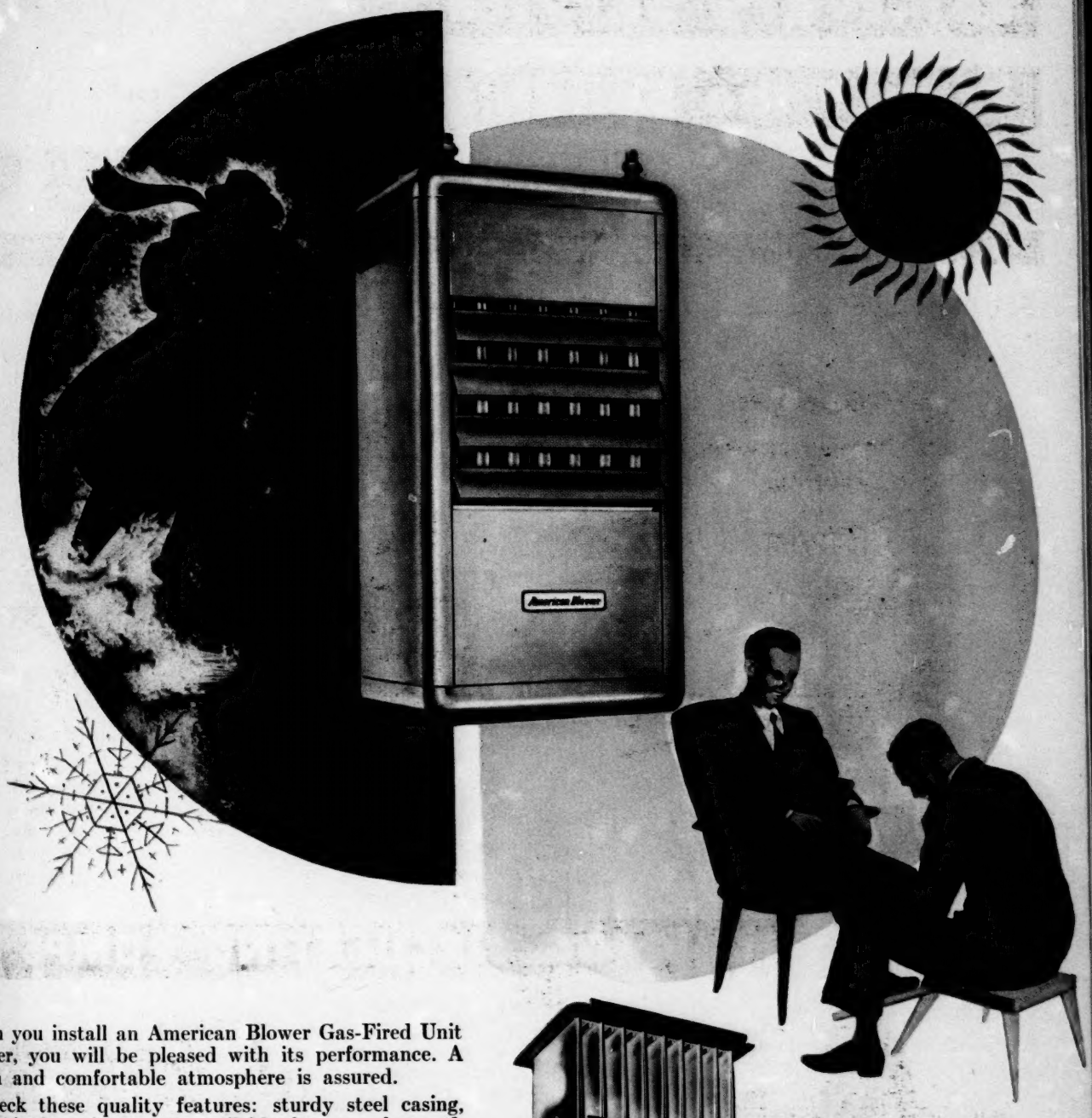
Condo-Vac, Sure Return. AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems.



Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.

**American Blower — a time-honored name in air handling**




When you install an American Blower Gas-Fired Unit Heater, you will be pleased with its performance. A warm and comfortable atmosphere is assured.

Check these quality features: sturdy steel casing, bonderized against rust; available for manufactured, mixed, natural or LP gases; combustion chamber resists high temperatures and corrosion; quiet, efficient operation; carries Underwriters' Laboratories and A.G.A. approval.

Contact your heating supply house or call the nearest American Blower Branch Office.

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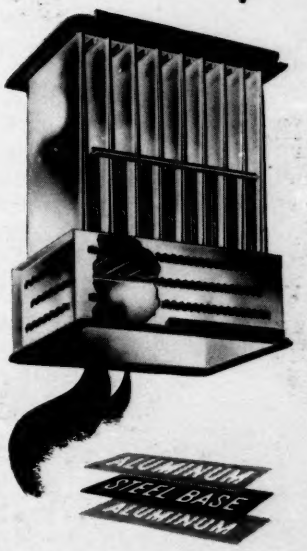
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

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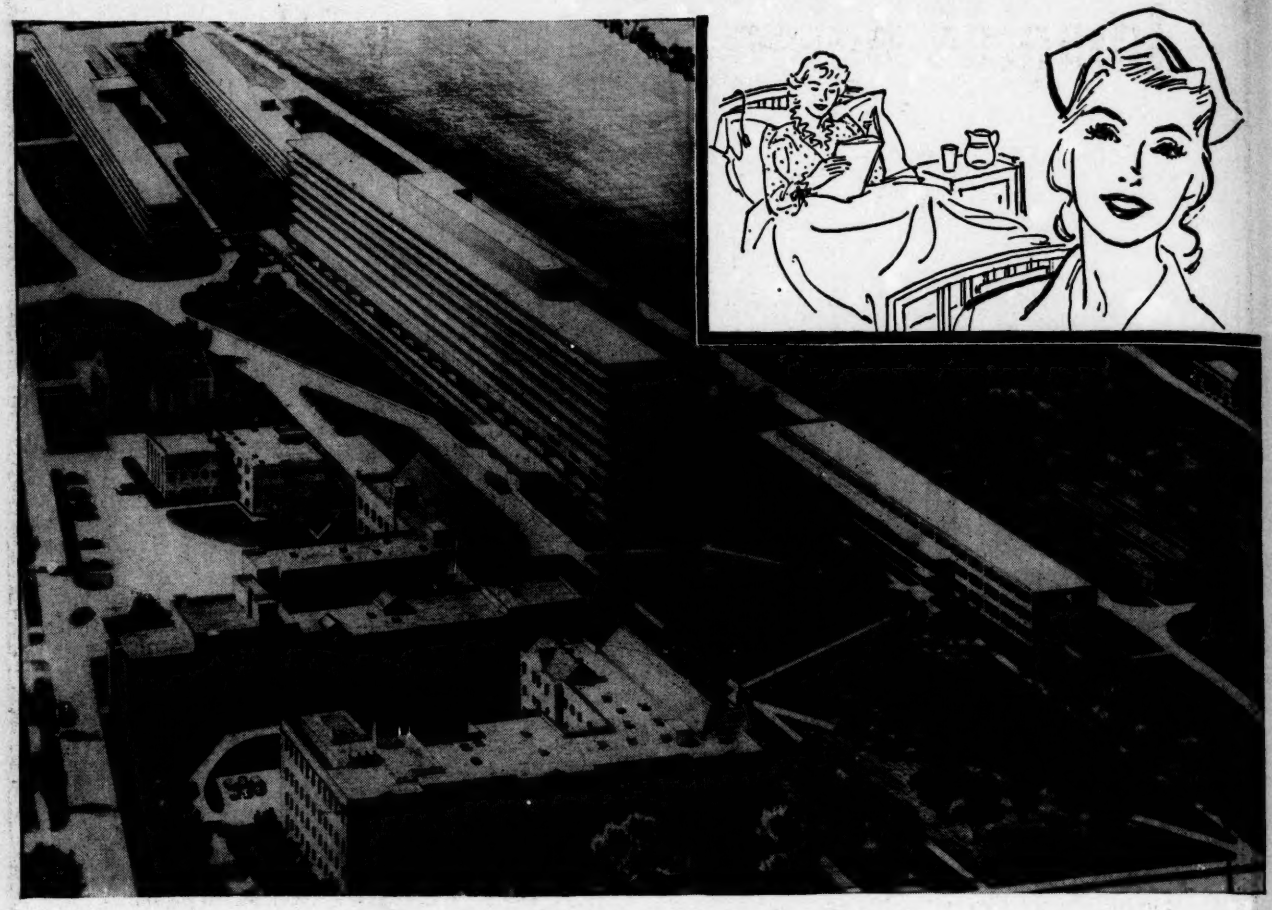
AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

# *"The patient's doing nicely, thank you"*



*In this ultra-modern hospital*

## RADIANT HEATING

*promotes comfort too!*

How the "lady with a lamp," performing her errands of mercy, amidst crowded pallets of Crimean wounded, would have marvelled at the hospitals of today! To Florence Nightingale, the modern facilities for easing pain and suffering would have been unbelievable. And, *now,* even the therapeutic comforts of radiant panel heating contribute to the arts of healing!

As in this 11-story, 600-bed Ohio State University Medical Center, steel pipe radiant panel systems bring new conceptions of heating comfort to hospitals, institutions, schools, commercial and public buildings and, of course, modern new homes.

Steel pipe, more than any other, has made the large-scale application of radiant heating economically practical in any type of building; while the demonstrated performance capacity of steel pipe in hot water and steam heating systems, for more than 60 years, attests its complete reliability and durability in service. That's why steel pipe is first choice—the most widely used pipe in the world—for radiant panel heating!

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AMERICAN IRON AND STEEL INSTITUTE

**350 Fifth Avenue, New York 1, N.Y.**

# Imagine doing business with 1890 methods!

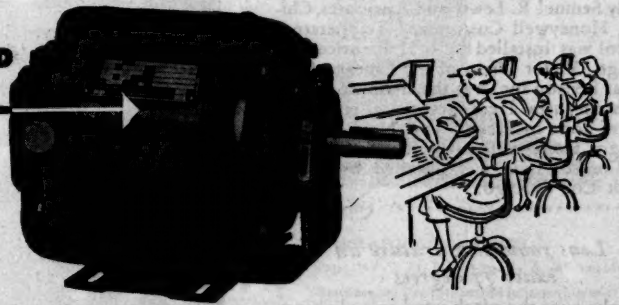
The bookkeeper with his eye shade and sleeve garters, at a high top desk, typified the tempo of business in the Gay 90's. His was a tedious and exacting job. Motorized equipment such as adding machines, calculators, bookkeeping machines, tabulating machines, postage meters, and letter openers, to name a few, were still in the future.

During this period Emerson-Electric was founded. Since then motors have been supplied to scores of leading manufacturers of labor-saving devices.

They staked the reputation of their products on Emerson-Electric motors, and with the passing years became nationally known for dependable service.

Consider this 62-year-old reputation for dependability and efficiency, earned by Emerson-Electric motors for use in business, on the farm, in the home and in industry. Your inquiry is invited on the complete line of standard motors in horsepower ratings from 1/20 to 5, and hermetic motor parts 1/8 to 10 H.P.

**MODERN BUSINESS IS POWERED WITH ELECTRIC MOTORS**



**Write for these Emerson-Electric Motor Data Bulletins**

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ M133-A Capacitor-Start
- ☐ M133-B Split-Phase
- ☐ M133-C Integral
- ☐ M133-D Fan-Duty
- ☐ M133-E Oil-Burner
- ☐ M133-F Jet Pump
- ☐ M133-G Blower

THE EMERSON ELECTRIC MFG. CO., St. Louis 21, Mo.

EMERSON ELECTRIC

MOTORS • FANS APPLIANCES

LEADERS IN THE FAN AND MOTOR INDUSTRY SINCE 1890

# How Honeywell Customized Temperature Control Helps Bell and Howell Meet Wide Range of Temperature Needs

*Specially designed system provides precision industrial control, finest comfort—and saves fuel*

These dramatic photographs of Bell and Howell's Chicago plant demonstrate the kind of operation that has made the company one of the world's leading manufacturers of motion picture projectors, cameras and microfilm equipment.

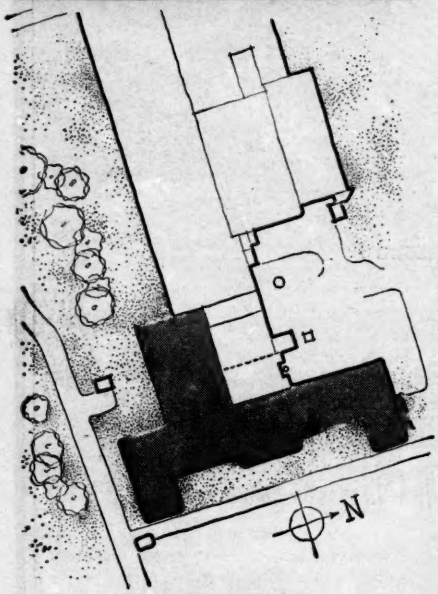
And they serve, too, to demonstrate the great flexibility of Honeywell Customized Temperature Control.

At Bell and Howell, this specially designed system provides factory personnel, office workers and executives with the finest kind of comfort.

But there's more to the story.

Many phases of an operation that produces such precision equipment as cameras, projectors and film demand extremely precise temperatures. These, too, are provided by Honeywell Customized Temperature Control.

And it's this customized control system that enables Bell and Howell to save a great deal on fuel bills each year—by setting back the temperature at night in big factory areas.



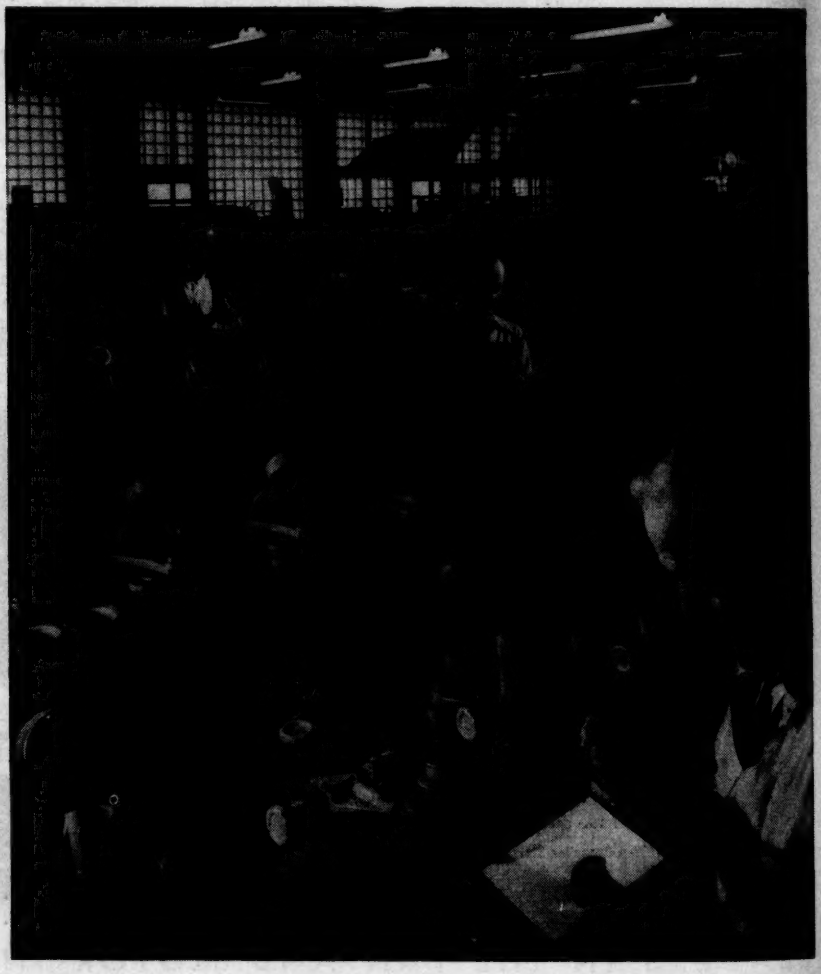

### *Over a half million square feet of factory, office*

The shaded area on the floor plan indicates the air conditioned sections of the plant. Located here are offices, some shipping and stores, some manufacturing. The unshaded portion is mainly manufacturing, partly shipping and storage area.

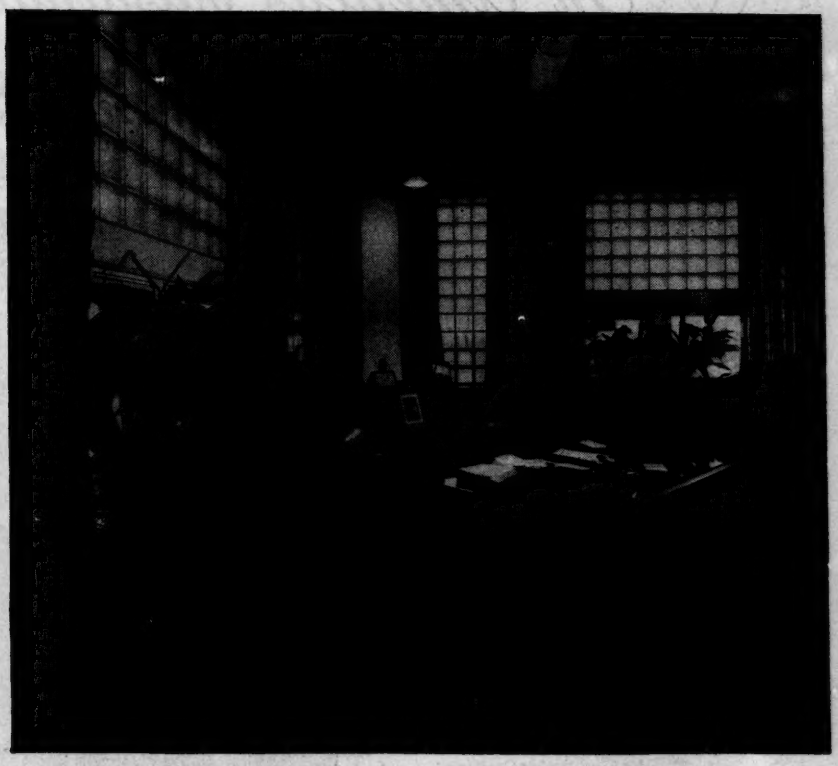
Architectural firms that designed the main plant were Mundie, Jensen, Bourke and Havens, Chicago, and Bruce A. Gordon and Company, Chicago. Mechanical engineering was by Samuel R. Lewis and Associates, Chicago. Honeywell Customized Temperature Control was installed by L. H. Prentice Co., Chicago. Victor Charn of the Chicago firm, Ragnar Benson Inc., was the architect for the new factory area. Here mechanical engineering was done by Nelson and Nettnin, Inc., Chicago. Honeywell Customized Temperature Control here was installed by O. A. Wendt Co., Chicago.

### *Lens room temperature an exact 77 degrees*

To make sure the pitch used in polishing precision optics retains the proper consistency, Honeywell Customized Temperature Control keeps the temperature exactly 77 degrees in the lens polishing room, right. And in Bell and Howell's film plant in Rochester, N. Y., customized temperature control guards another vital manufacturing process. There, a variety of temperatures—all different—are held at the critical level with a tolerance of only one-half of one degree Centigrade.



**In the company's projection salon** as many as 50 persons can meet to view business and training films. Smoking is permitted, yet the air is never clouded. Honeywell Customized Temperature Control takes care of that—removing stale air and replenishing it with fresh air for complete comfort.



**The final test line** for Bell and Howell's famous 16 mm. Filmosound projector is shown above. It is in this area that Honeywell Customized Temperature Control makes possible great fuel savings. For here a master thermostat can be turned down at night to lower temperatures when the area is not in use.

**Executive offices like this** are perfectly comfortable—no matter how changeable the weather outside. Because in the office area Honeywell Customized Control provides an *individual* thermostat for every room. This thermostat can be adjusted by room occupants to give them the exact temperatures they want. And the ultimate in comfort such a system guarantees is shared by all who work in this part of the plant—secretaries, typists, restaurant personnel and executives. This raises efficiency and helps make Bell and Howell a pleasant, comfortable place to work—in August as well as in January.

## *For Comfortable, Even Warmth in New or Existing Public Buildings, Specify Honeywell Customized Temperature Control*

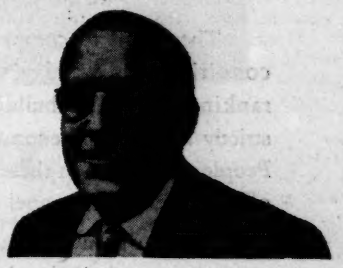
Whether it's a factory, store, office, school, garage—or any size public building—new or existing—there's a Honeywell Customized Temperature Control System to meet your clients' heating and ventilating problems.

Once equipped with a Honeywell Customized Temperature Control System, they'll have the right kind of controls to keep their employees, customers and tenants comfortable—and they'll save fuel besides.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. There are 91 across the nation. Or mail the coupon today.

***"I'll bet no other factory has better control over its heating and air conditioning," says Bell & Howell Superintendent of Maintenance Branson "Buck" Weaver.***

"This Honeywell Customized Temperature Control keeps *everyone* comfortable. And it keeps *me* happy because it requires almost no maintenance. Besides that, I enjoy reporting the latest fuel-saving figures."



MINNEAPOLIS
**Honeywell**

First in Controls

MINNEAPOLIS-HONEYWELL
Dept. HV-9-71, Minneapolis 8, Minnesota

Gentlemen: I'm interested in learning more about your Customized Temperature Control Systems for public buildings.

Name_____

Firm Name_____

Address_____

City_____ Zone____ State_____

# *In America's outstanding buildings... you'll find engineered* T&B *products*

REINHARD, HOFMEISTER & WALQUIST
Architects

•

GUY B. PANERO
Consulting Engineer

•

TURNER CONSTRUCTION COMPANY
General Contractor

•

RAISLER CORPORATION
Heating, Ventilating and
Air Conditioning Contractor

•

## IN THE CHRYSLER BUILDING, EAST NEW YORK CITY

The trend to complete air conditioning in today's top-ranking new office buildings is strictly a matter of economics. People who work in these air conditioned offices enjoy year-round, health-giving comfort that pays off in increased personnel efficiency.

The new Chrysler Building East is typical. Here, once again, when architects, engineers and contractors made their selection of air conditioning equipment, Tuttle & Bailey products were chosen to complement the installation. Throughout Chrysler Building East AT THE VITAL POINT OF AIR DELIVERY, Tuttle & Bailey Aerofuse Square Ceiling Diffusers, Tri-Flex Grilles and Aerovane Registers assure both the comfort of tenants and the efficiency of the system.

Particularly in installations like this, where widely varying private office, general office and service areas create problems in air distribution, Tuttle & Bailey products... backed by the Industry's most complete engineering and test facilities . . . play a key role in satisfactory performance. In design and installed appearance they measure up to the most exacting requirements of architect and decorator.

For further information, write for Catalog No. 104 and 48S.

5TB52

**INSTALLED AT THE VITAL POINT...OF AIR DELIVERY**

***Aerofuse***

**CEILING DIFFUSERS**

***Tri-Flex Aerovane***

**GRILLES and REGISTERS**

TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT

# The C-E re-circulation Steam Generator

**is convenient . . . reliable . . . compact . . . economical . . . fast, says Mr. Loy**

LOY-LANGE BOX COMPANY
222 RUSSELL AVENUE
ST. LOUIS 4, MISSOURI

May 14, 1952.

Combustion Engineering - Superheater, Inc.,
5319 Shreve Avenue,
St. Louis 15, Missouri.

Attention: Mr. W. J. Woodruff
District Manager

Gentlemen:

A little over a year ago we installed in our plant a C.E. Re-circulation Steam Generator. This unit, rated at 4,000 pounds steam per hour at 150 Psi., serves a 63 inch corrugating machine and a heating load of approximately 50 H.P. Your steam generator has handled the load with ease. The unit has been in practically continuous operation, the only interruption being for routine maintenance and one or two service operations of a minor nature.

We like this unit and are pleased to give it our sincere recommendation. It has proved to be a reliable source of high pressure steam. It follows our extremely fluctuating load condition without drop in steam pressure. It is extremely compact in relation to amount of steam delivered. The installation has enabled us to use considerable of the floor space formerly occupied by previous installation of fire tube boilers. Fuel economy is worthwhile since it is efficient while in operation and there are no banking losses. The unit can be brought up to full operating condition from a cold start in just a few minutes.

In purchasing this equipment from your company, we were influenced by the manifest quality of the product indicated by our visual inspection and by the reputation of your company for adequate service. Both the product and the service have lived up to our expectation. We believe the Re-circulation Steam Generator is an advanced design for steam generation in small units, and we wish you all success in the promotion of your product.

Yours very truly,

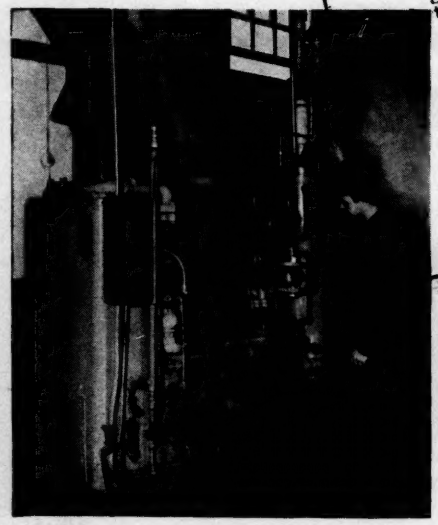
LOY-LANGE BOX COMPANY

S. K. Loy
President

REC'D MAY 16 1952 Combustion Engr. Co. St. L. Sales

SKL:fs

This is the installation to which the letter refers



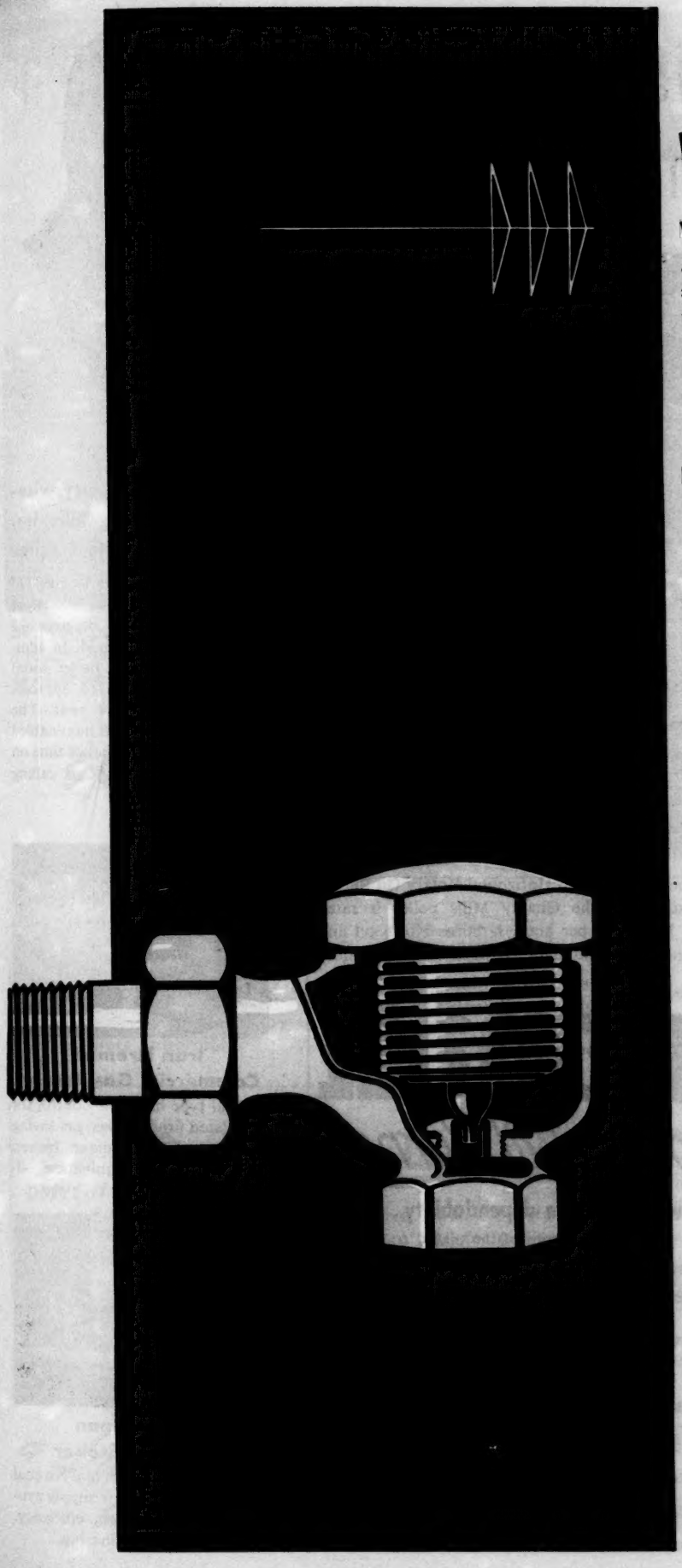
C-E

**COMBUSTION ENGINEERING—SUPERHEATER, INC.**

200 Madison Avenue, New York 16, N. Y.

B-597

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



# WHY?

**WHY IMPORTANT?**

... because more thermostatic steam traps are used in heating systems than any other type. The efficient operation of the heating system depends upon the selection of traps which will perform satisfactorily over a long period with a minimum of maintenance.

**WHY DO ARCHITECTS AND ENGINEERS SPECIFY SARCO?**

... because from experience they know that Sarco Thermostatic steam traps operate to the client's satisfaction.

**WHY ARE SARCO TRAPS SUPERIOR?**

... because of continuous laboratory research, rigid control of raw materials, master craftsmanship, careful inspection of component parts — all of which are manufactured in the Sarco plant ... because each trap, before shipment, is tested under actual working conditions.

**WHY DO CONTRACTORS PREFER SARCO?**

... because they pay no premium for Sarco quality and performance ... because they know that the first cost is the only cost. The *complete* Sarco line provides them with a single, dependable and reliable source of steam and hot water heating specialties and industrial controls described in the Sarco heating bulletins.

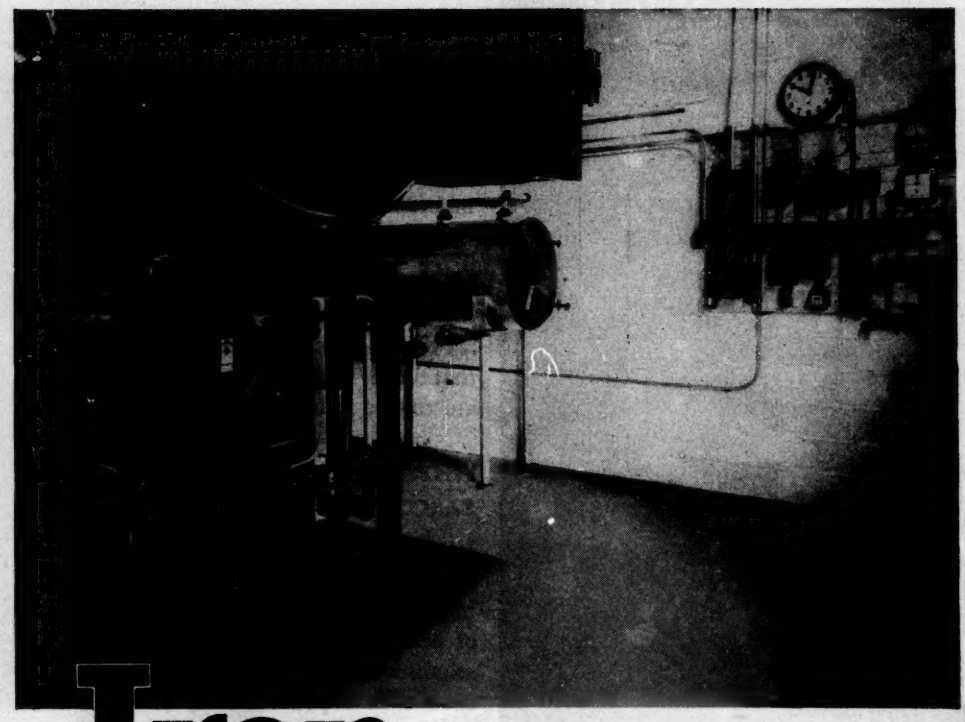
**SARCO** saves steam

sarco quality assures satisfaction

**SARCO COMPANY, INC.**
Empire State Bldg., New York 1, N.Y.
REPRESENTED IN PRINCIPAL CITIES
Sarco Canada Ltd., Toronto 8, Ont.

402

# We save $3800 a year with our Iron Fireman Rotary Oil Burner



**says Mr. J. Mayberry, vice-president, Quality Mills, Inc. Mount Airy, North Carolina**

"Our Iron Fireman Rotary Oil Burner has resulted in $1,800 per year savings in fuel cost over our previous firing method. In addition to this, other boiler room economies amount to approximately $2,000 per year. The efficiency of this unit has enabled us to save a great deal of time on many of our operations calling for quick steam."

The Iron Fireman Horizontal Rotary Oil Burner installed in the Quality Mills boiler is rated at 75 gallons per hour. It burns No. 6 oil and being fully automatic, requires little attention.

# Iron Fireman

## *Horizontal Rotary Oil Burner*

**fires fuel oil of any weight with complete dependability**

The changeable viscosity of heavy oils was heretofore the toughest problem in firing these heat-rich economical fuels. When warm, they flow freely—when cold, they are almost as sluggish as tar. The Oil Volumeter, with which the Iron Fireman burner is equipped, solves this problem of varying viscosities. Adjustable pistons feed a definite *volume* of oil with each stroke, regardless of the physical properties of the oil.

You save two ways. The heavy oils cost you less per gallon, yet you get up to 12% more Btu's than from lighter oils. The Iron Fireman Rotary Oil burner keeps a steady flame even when throttled down to less than 20% of capacity. . . Facilitates quick starting in cold boilers. . . Capacities up to 500 boiler h.p.

**AUTOMATIC FIRING FOR HOMES, BUILDINGS, INDUSTRIAL PLANTS**

IRON FIREMAN MANUFACTURING CO., 3280 West 106th St., Cleveland 11, Ohio.

Please send literature as checked:

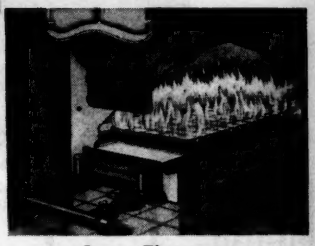
- ☐ Rotary Oil Burner
- ☐ Commercial Gas Burner
- ☐ Coal-Flow Stoker

Name_____

Address_____

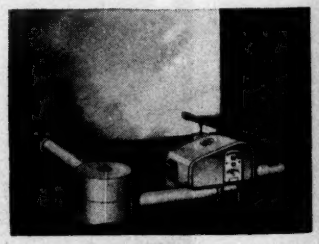
City_____ State_____

**Mail coupon for literature and complete information.**



**Iron Fireman Commercial Gas Burner**

Vertical type has zone control for modulated firing. Other gas-saving models include Radiant Inshot, Ring-Type and combination oil-gas burner.



**Iron Fireman Coal-Flow Stoker**

Feeds coal direct from bin. No coal handling. Fuel and air supply synchronized for utmost efficiency. Capacities to 500 boiler h.p.

# DUCTWORK FASTENED TO CONCRETE IN SECONDS with DRIVE-IT

Ductwork goes up faster, easier at less cost when Drive-It is used to anchor it to concrete. Contractors of all building trades speeded their work on the new Lincoln High School at Portland, Oregon, with Drive-It fastening system.

## split-second fastening to concrete steel

**Drive-It uses a small powder load to drive hardened steel pins into concrete or steel. No power lines! No drilling!**

UL

***DRIVE-IT*** is the only powder-actuated tool approved by Underwriters' Laboratory.

***DRIVE-IT*** cannot be discharged accidentally due to the push and turn sequence. This, plus the large safety pad makes *DRIVE-IT* triple safe.

Exclusive Automatic Barrel Extension for fastenings inside junction boxes or other recesses.

***DRIVE-IT*** is the only powder-actuated tool which requires but one standard power load regardless of penetration desired.

Exclusive Swivel Safety Pad easily rotated for getting into close quarter work.

***DRIVE-IT*** "300", lowest cost fastening tool. Low original cost and low operating cost.

a drive-pin for every job

**OVER 50 TYPES AND SIZES**

**MAIL THIS COUPON TODAY!**

**POWDER POWER TOOL CORP.**

0712 S. W. Woods St., Portland 1, Oregon

Canada: Ammo Power Tool Co., Ltd.
735 Broadway, Vancouver, B. C.

☐ Please send FREE catalogue and literature.
☐ I want a FREE demonstration of *DRIVE-IT*.

Name_____

Street_____

City_____ State_____

# THESE MODERN STEAM-PAK * GENERATORS

# FEATURES WILL SAVE YOU THOUSANDS

**FORCED DRAFT BLOWER**

Room air at 70° is blown into the front of the boiler to produce forced draft at the lowest h.p. per volume air. This method also eliminates mechanical maintenance found with induced draft type fans.

**BURNER AIR COMPRESSOR**

Fuels are atomized at the burner nozzle by using compressed air which breaks up completely all the various grades and types of residual oils into gases, assuring easier start and more efficient combustion.

**COMBUSTION CHAMBER**

Preformed carborundum blocks—factory designed and built—are used in the making of the combustion chamber due to its high heat transfer, dependability and long life with easier maintenance or replacement.

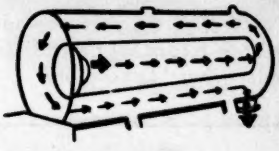
# OF DOLLARS A YEAR ON STEAM COSTS

**SWIRLING FLAME**

High speed flame travel with exceptionally high heat transfer is obtained by a unique air injection mechanism that swirls the flame around the combustion chamber but keeps loose flames from impinging chamber.

**TARGET RING**

Located in an intermediate position in the combustion chamber is a carborundum ring that reforms the flame by squeezing it, drawing the outer circle of pre-heated air into the center of the flame.



**THREE PASS**

Maximum absorption of heat of combustion by the boiler water is obtained as the gases pass through the combustion chamber (1st pass), the top bank of tubes (2nd) and the bottom bank of tubes (3rd).

* With the exclusive Iris Shutter and Metering Oil Pump which automatically regulate air and oil flow to load requirements, York-Shipley Steam-Pak Generators are the most efficient on the market today. Available in a complete range of sizes from 15 to 300 h.p. for all grades of fuel oil or gas or a combination of gas and oil, these Steam-Paks save their users many thousands of dollars a year.

**GET THIS BOOK TODAY!**

"Steam in a Package"—
a 14-page book which tells the installation and operating advantages of York-Shipley Steam-Pak Generators.
Write today for your free copy of Bulletin 201.

Steam-Pak Generators—A Product of York-Shipley, Inc., York, Pa.

# positive shut-off with

# MUELLER BRASS CO. *Streamline*®

# CAST BRONZE VALVES

You always get fast, positive shut-off with Mueller Brass Co. valves because all working parts are accurately machined for perfect alignment with the seating surface in the non-porous, cast-bronze body. Large easy-grip aluminum handwheel is designed to minimize heat transfer to the hand. There are valves for every type of service. They feature heavy duty construction throughout... and are engineered for easy installation. The most frequently required, standard sizes and type of end-fittings are available. Like all Mueller Brass Co. Streamline products, these valves are designed and built to really stand up on the job —to give years of satisfactory service.

**GATE VALVES**—non-rising stem model permits installation in minimum space.

**GLOBE VALVES**—tough composition disc gives firm seating and resists high temperatures.

**COMPRESSION STOPS**—ful-flo design eliminates restriction in the line. Available with or without drain.

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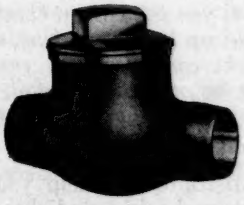
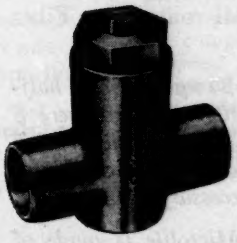


**SWING CHECK VALVES**—internal swivel pin construction eliminates external packing, packed gland and nut.



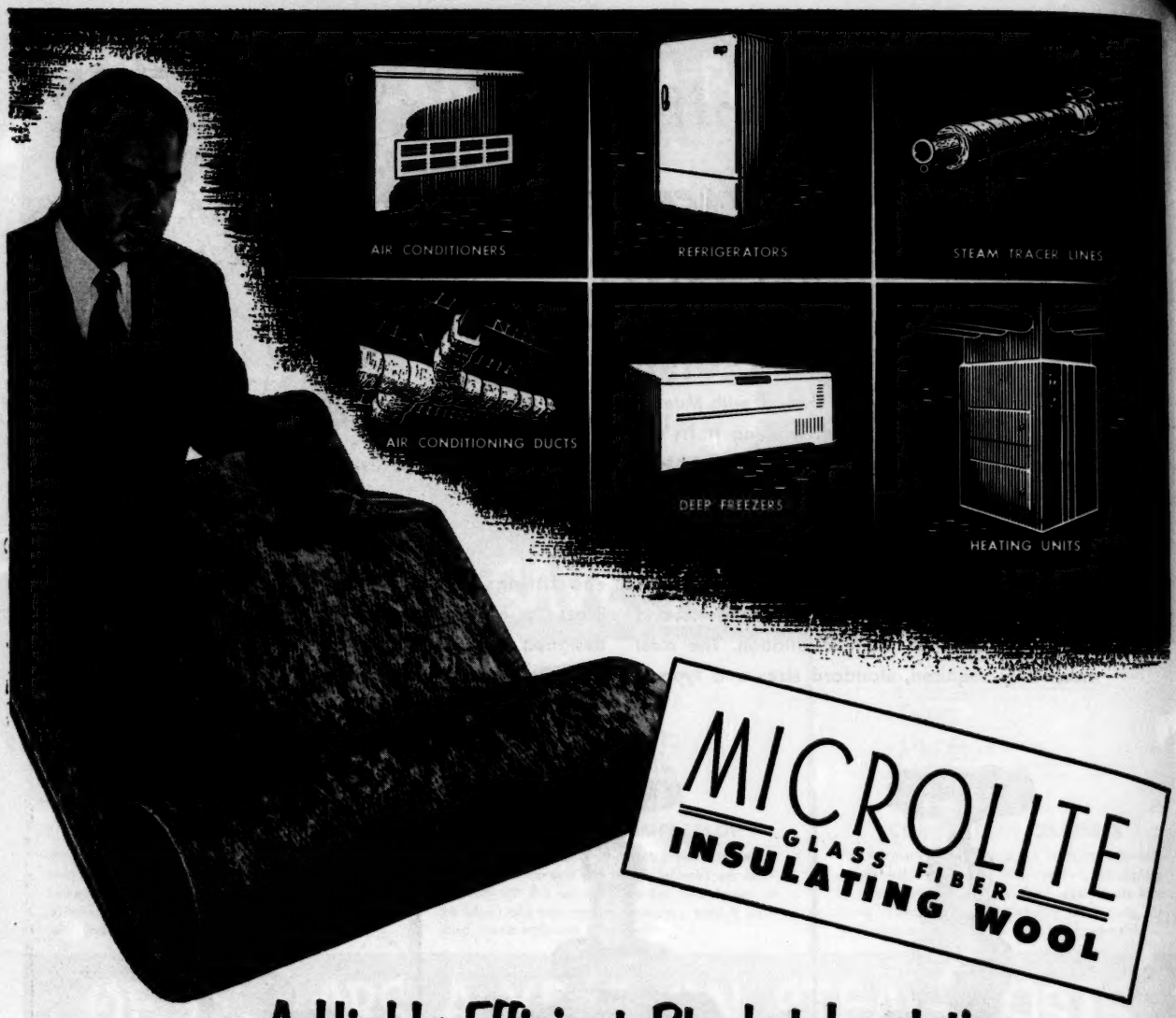
**FLOW CONTROL VALVES**—ideal control valve for radiant panel heating. Compact design requires minimum installation space.

See your jobber for further information or write for catalog S-352 describing our complete line of **STREAMLINE** wrought copper and cast bronze fittings.

"STAMP" OF STREAMLINE PRODUCTS

## MUELLER BRASS CO.

PORT HURON 2, MICHIGAN




# MICROLITE
GLASS FIBER
INSULATING WOOL

## A Highly Efficient Blanket Insulation

**. . . for effective control of temperature and sound**

If you have a heating, refrigerating or air conditioning application that calls for an insulation with the most effective thermal-acoustical qualities, you might well ask these questions about Microlite Glass Fiber Insulating Wool:

**Is it easy to apply?** . . . *24 square feet of half-inch, half-pound Microlite weighs a mere 8 ounces. Large sections can be quickly and easily applied, like a downy blanket. Knife or shears are the only necessary cutting tools.*

**Is it permanent?** . . . *Microlite is made of glass fibers that resist fire, corrosion, moisture and vibration settling. It does not decay and provides no nutriment for fungi or vermin.*

**Does it insulate well?** . . . *Inch for inch, Microlite is one of the most efficient of all insulations. 1 lb. density material has a "k" factor of .21 at 75° F. mean temperature.*

**Are convenient sizes and types available?** . . . *It comes to you in resilient blankets up to 72 inches wide, up to 200 feet long, and up to 3 inches thick; compressed in easily-stored rolls. It may be ordered with foil, reflective coated paper and reinforced or unreinforced paper vapor barriers.*

Perhaps Microlite can help you cut installation costs and achieve a lighter finished application. For more information and samples, write Glass Fibers Inc., 1810 Madison Avenue, Toledo 2, Ohio.

A Vitron® GLASS FIBER PRODUCT

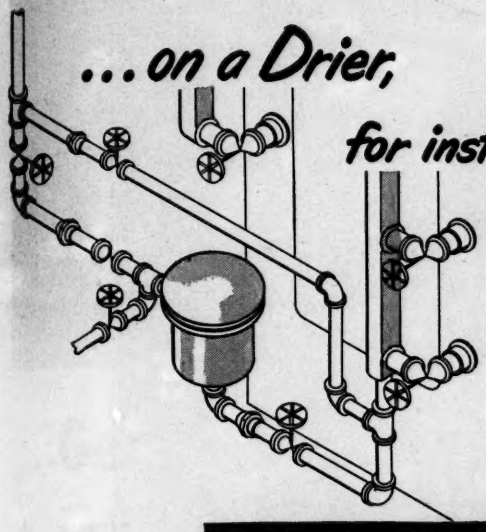
*Sales Offices and Distributors in Principal Cities*

# GLASS FIBERS INC.

**Makers of glass fibers by the ELECTRONIC-EXTRUSION process . . . developed, patented and used exclusively by Glass Fibers Inc.**

# Example of Steam Trap Durability

...on a Drier, for instance



## THE INSTALLATION

On heavy-duty, steam-heated tumbler-type drier at American Linen Supply Company, Cincinnati.

## THE HISTORY

A high discharge capacity trap was needed to operate this drier 16 hours daily under heavy loads, with 125 psi. steam. Specifications called for rapid, fully automatic condensate removal to insure fast warm-ups and a steady flow of hot, dry steam to the drier. Naturally, the lowest possible trap maintenance cost was also wanted.

The choice was a Crane 150-Pound Inverted Open Float Steam Trap, carefully selected for adequate drainage capacity, and above all, properly installed.

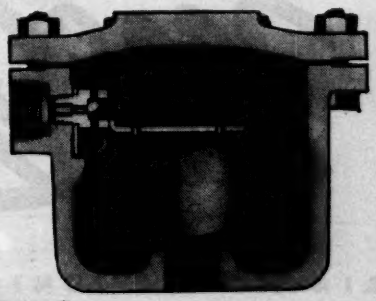
In service more than 8 years and never needing any repairs or new parts, the Crane trap has given complete satisfaction. Total maintenance expense: periodic routine inspection only.

## TRAP SERVICE RATINGS

| | |
|---|---|
| SERVICE LIFE: | More than 8 years - Heavy duty |
| SUITABILITY: | High discharge capacity |
| MAINTENANCE COST: | None - Routine inspection only |
| SPECIAL FEATURES: | Simple, dependable mechanism |
| OPERATING RESULTS: | Fast warm-ups - Steady even heat |
| PRICE: | Good Buy |
| AVAILABILITY: | Stock item in Crane line |

## THE TRAP

Crane Iron Body Inverted Open Float Steam Trap, for 1 to 300 pounds saturated steam working pressures. Small and compact in all sizes, yet has high discharge capacity. Patented ball-type seating gives positive pressure seal. Simple operating mechanism with only one moving unit assures durable, trouble-free performance. See your Crane Catalog or your Crane Representative for complete data on these highly efficient traps.



*The Complete Crane Line Meets All Valve Needs. That's Why,*

**More Crane Valves Are Used Than Any Other Make!**

# CRANE VALVES

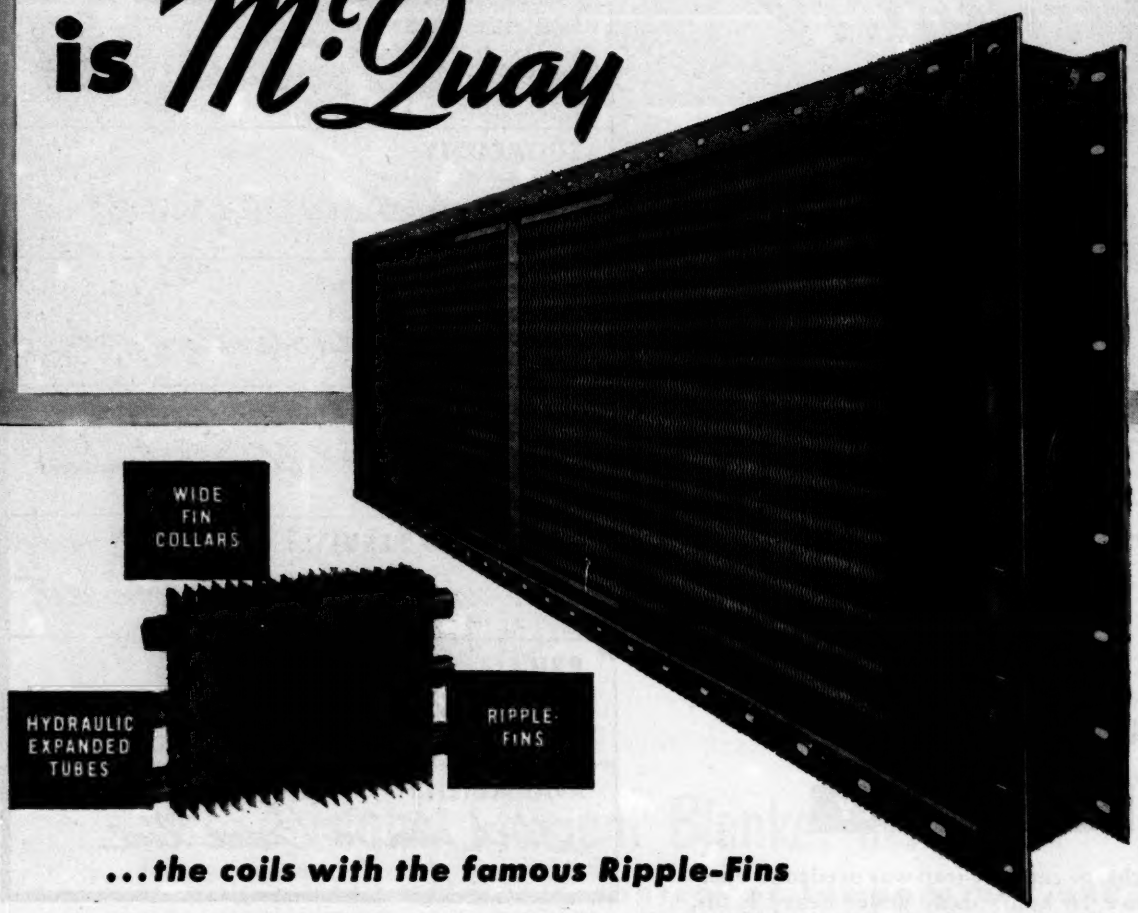
CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

*Branches and Wholesalers Serving All Industrial Areas*

**VALVES • FITTINGS • PIPE • PLUMBING • HEATING**

# the name for top efficiency in coils

# is McQuay




## ...the coils with the famous Ripple-Fins

McQuay's ripple-fin surface is the product of years of research aimed at producing the ultimate in heat transfer for any weight metal. High efficiency is assured by forcing the air to follow an ever-changing direction of flow in passing through the coil. Thus the air repeatedly contacts the coil surface to give maximum contact time, maximum contact velocity, and a resultant optimum heat transfer.

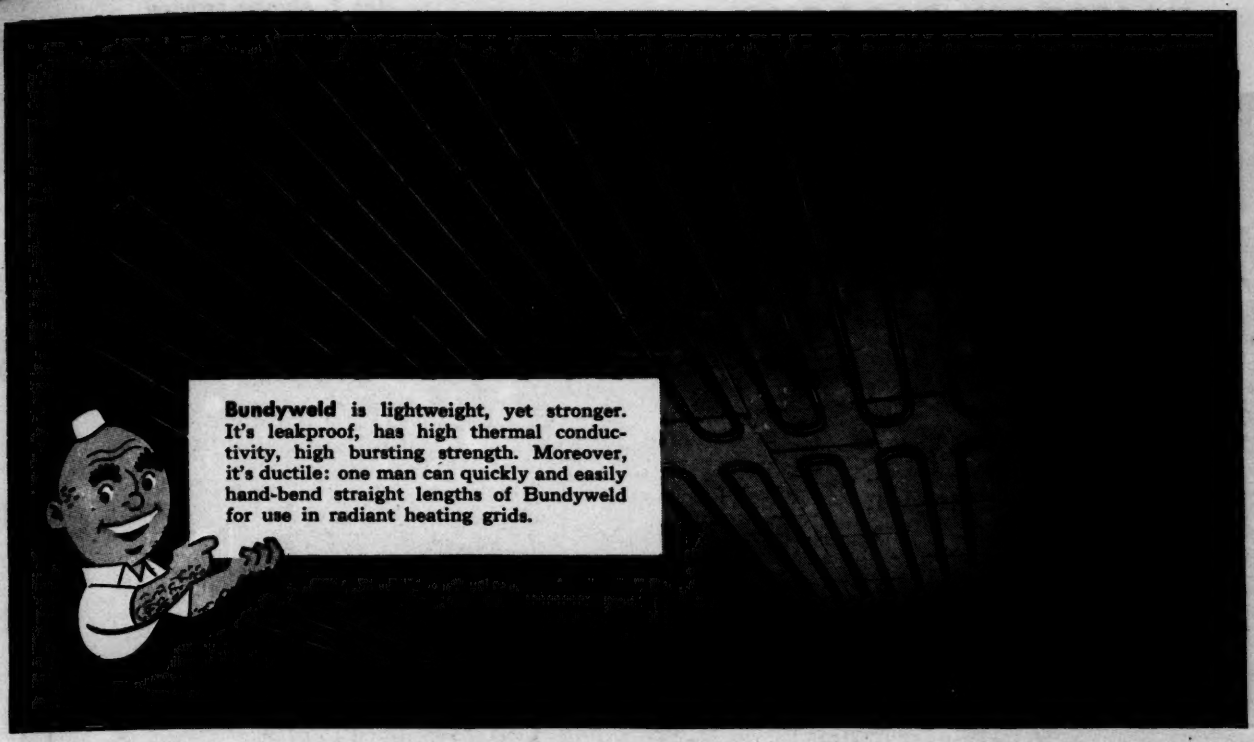
The staggered tube and rippled edge features also contribute greatly to the construction ruggedness and eye appeal of the famous McQuay line.

McQuay heating (blast) coils are available in a wide variety of styles and sizes. Hot water, cold water, brine, direct expansion, and refrigerant condensing coils are available for practically every type of application. Write McQuay Inc., 1619 Broadway St., N.E., Minneapolis 13, Minn. Representatives in principal cities.

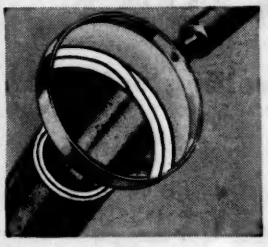
# McQuay INC.

MAKE THE SEASONS COME TO YOU

AIR CONDITIONING • REFRIGERATION HEATING


**Bundyweld** is lightweight, yet stronger. It's leakproof, has high thermal conductivity, high bursting strength. Moreover, it's ductile: one man can quickly and easily hand-bend straight lengths of Bundyweld for use in radiant heating grids.

# Get the edge on your local competition— with Bundyweld Ceiling Radiant Heating



### Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip. It's steel, copper-coated inside and out. It gives finest radiant heating performance, with savings up to 50% on material costs and installation time.

Standard 20' or 24' lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly soldered into leak-proof union. Joined, light-weight coils are easily mounted onto ceiling, quickly plastered over

**Think of** telling a prospect for a new heating job that his house can be free of sooty registers and radiators, free of heating drafts, free of the annoyance of streaked walls and ceilings.

Sound selling points? You bet they are, yet that's only the beginning: houses with Bundyweld Ceiling Radiant Heating offer air that's clean and fresh as spring, lower operating costs, and reduced housekeeping chores as well.

Beginning only recently, Bundy ads in *Better Homes & Gardens* and *American Home* have featured a coupon offering a free "Home Owner's Guide to Bundyweld Ceiling Radiant Heating." Since the offer began, almost 20,000 have been sent out to prospective home buyers! These people want to know more about today's most advanced, practical heating method; they want to know the names of builders and plumbing and heating contractors using it.

Put your business squarely in the path of this quickly growing interest. Put your business ahead of all competition in your area. Send the coupon below for details on Bundyweld Ceiling Radiant Heating and Bundyweld Tubing!

Bundyweld
Ceiling Radiant Heating

*Radiant Heating Division*
BUNDY TUBING COMPANY
*Detroit 14, Michigan*

Radiant Heating Division, Dept. HV-952
Bundy Tubing Company, Detroit 14, Michigan

☐ Send free 20-page nontechnical brochure explaining Bundyweld Ceiling Radiant Heating.

☐ Send Bundy technical radiant heating pamphlet.

Name_____ Title_____

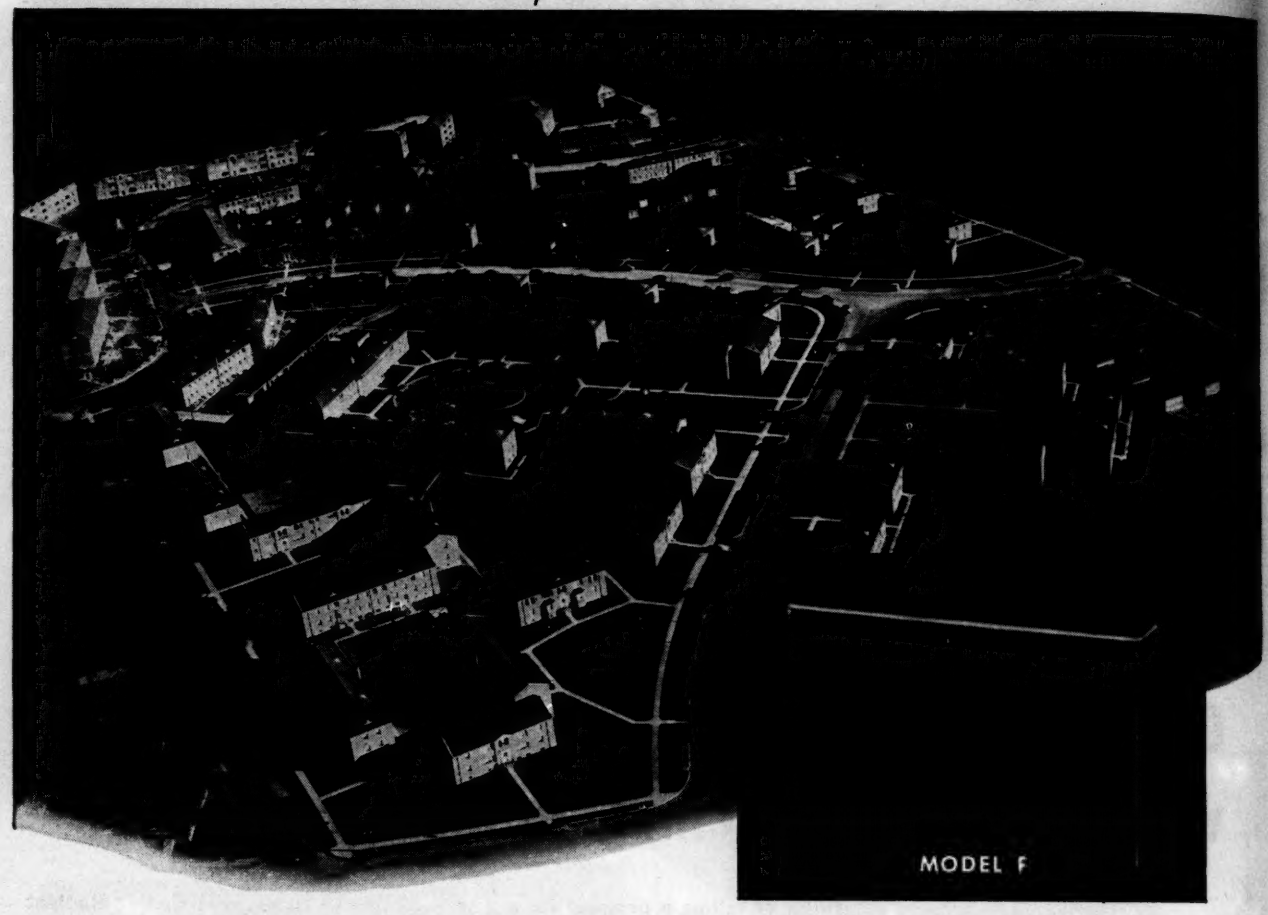
Company_____

Address_____

City_____ Zone____ State_____

# HAMPTON GARDENS, *St. Louis*

*Leo F. Abrams, architect*
*Natkin & Co., heating contractors*
*Webb & Knapp, Inc.*




# 3,200 AIRTHERM CONVECTORS

**selected to comfortably heat the 500 dwelling units of this new, self-contained residential community for Mid-America**

Here Airtherm Convectors fit functionally into the handsome Colonial design, demonstrating their wide adaptability to all types of decor, from traditional to modern. Savings in labor and installation costs were made possible by Airtherm's simplicity and ease in handling and connecting.

Airtherm Convectors are available for wall, recessed, or free-standing installation.

For Heating Satisfaction...
Think First of
*Airtherm*

Oil or Gas Direct Fired Heaters

Horizontal Type Unit Heaters

Vertical Type Unit Heaters

Centrifugal Fan Type Unit Heaters

**AIRTHERM MANUFACTURING COMPANY**
722 South Spring Avenue • St. Louis 10, Missouri

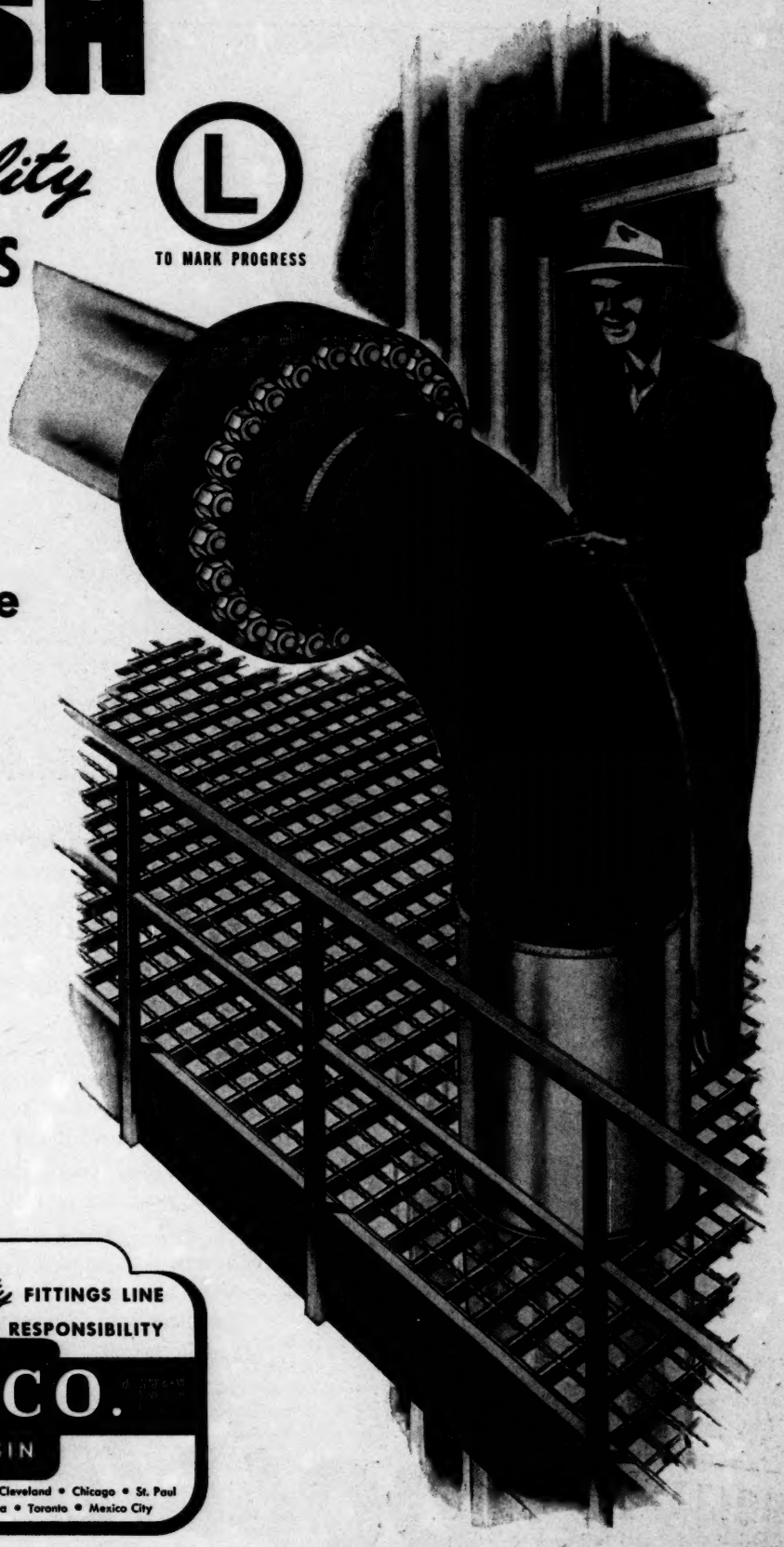
133

# LADISH

*Controlled Quality*

## PIPE FITTINGS

TO MARK PROGRESS



## metallurgically sound for maximum service

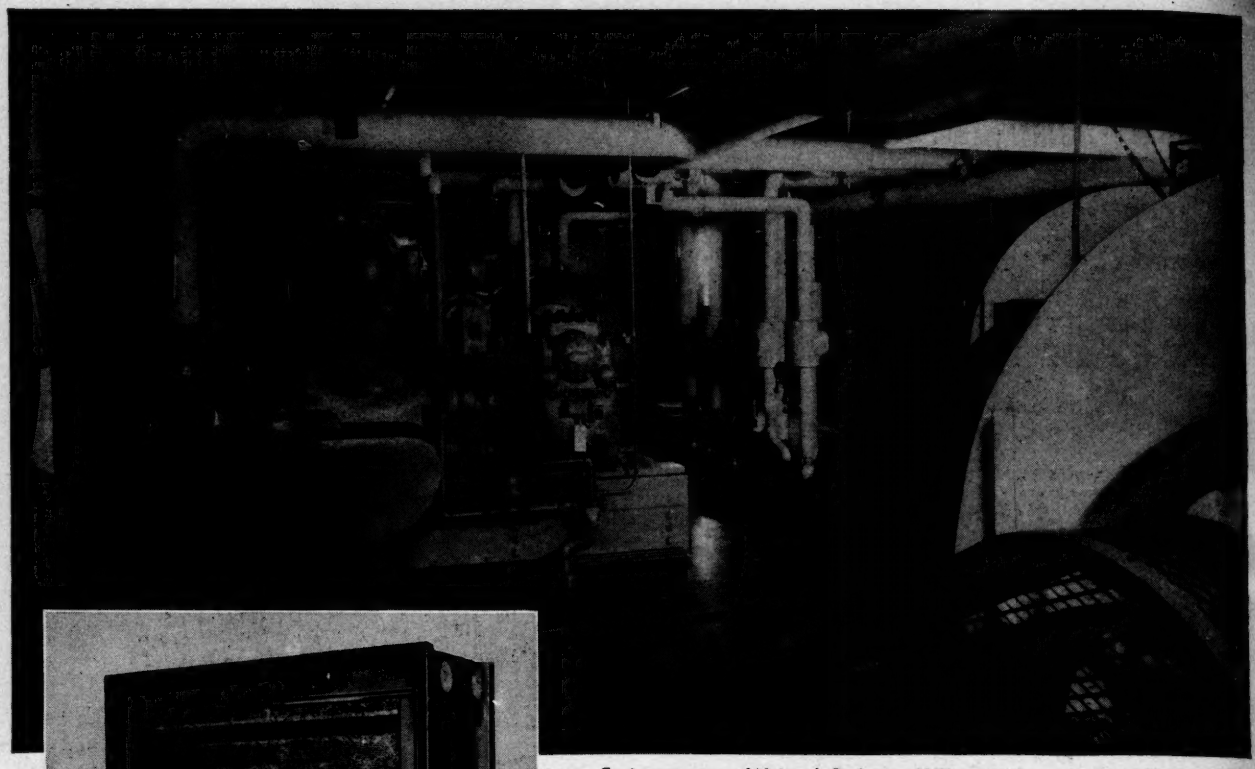
**Sound metallurgy . . . the result of unsurpassed facilities and advanced laboratory controls . . . provides the maximum of dependability in Ladish Controlled Quality fittings. Every phase of metal quality . . . composition, structure and physical properties . . . is continuously safeguarded—and certified proof of metallurgical integrity is available to users of Ladish fittings.**

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

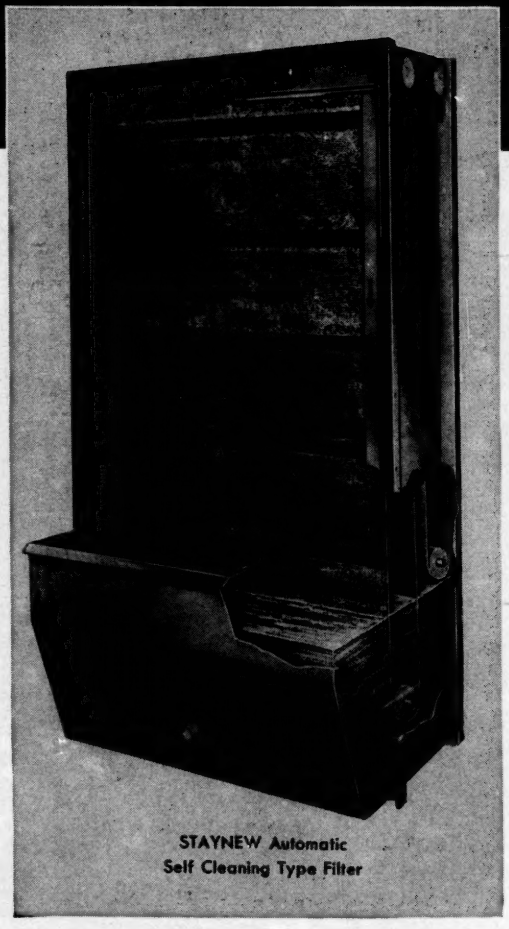
## LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • Havana • Toronto • Mexico City



Equipment room of Neisner's Rochester, N. Y. store where conditioned air is filtered in 3 units, each consisting of 2 sections, of Staynew Automatic Filters.



STAYNEW Automatic
Self Cleaning Type Filter

# Where Automatic Filters are used

# Neisner's Specify STAYNEW For Air Conditioned Stores

More consistent filtration . . . more efficient operation . . . more effective control of dirt and dust in sales area than conventional filters. *ALL* good reasons why Neisner Brothers Inc., national retail chain, specified Staynew Automatic Air Filters in their large post war stores.

Staynew Automatic Air Filters adapt themselves to all types of air conditioning systems—cooling, either by direct expansion or chilled water; heating, or refrigeration. Self cleaning and easily supervised by laymen, Staynew Automatics stay on the job 24 hours a day at peak efficiency.

Let Staynew show you how to filter larger volumes of air at *lower* cost. Write for descriptive folder.

REPRESENTATIVES IN PRINCIPAL CITIES

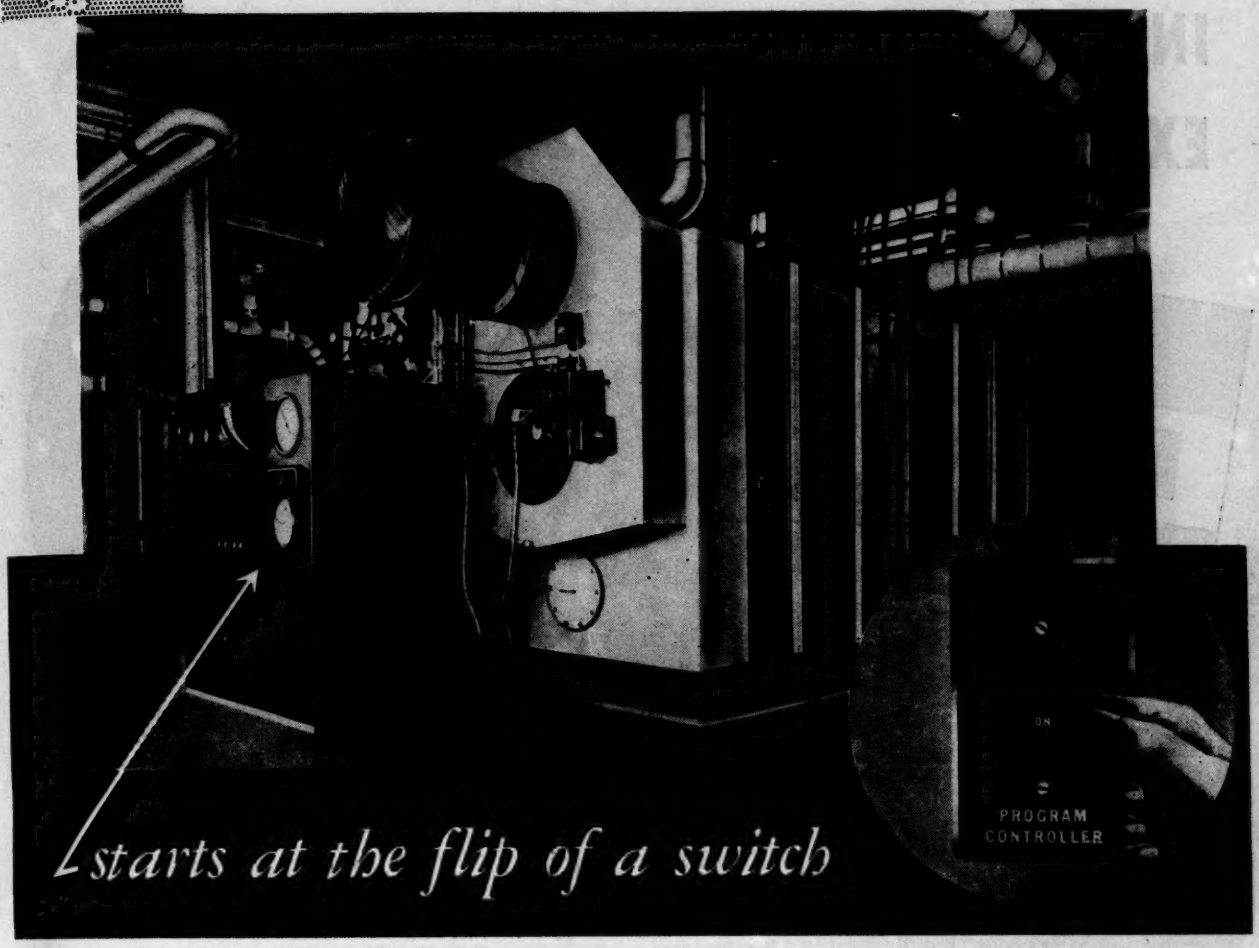
DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

# DOLLINGER CORPORATION

15 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

# shop-assembled Integral-furnace boiler, type FM




Automatic, efficient boiler operation with complete safety is assured by the positive dual control system offered with the B&W FM Boiler.

After the usual service operations are performed —water, fuel, and electric power turned on—a flip of a switch sets the starting program controller in operation and, in a matter of seconds, your FM Boiler is started.

Not only that! During the start-up, your FM Boiler is protected by sensitive safety devices, available with this unit, that automatically shut down your FM Boiler at the first detection of even slight malfunctioning. These electrical "policemen" act faster than an operator in case anything unusual happens—as it sometimes does with any boiler.

After your FM Boiler is started and is up to pressure, an automatic control not only provides fuel feed as required but also proportions fuel and air for best performance, all under control of safety devices.

When load conditions are so light that your FM Boiler must operate below about 25% of rated capacity—always a troublesome condition—an ON-OFF control is available to smoothly and safely start and stop the boiler automatically on the proper cycle to keep steam pressure within desired limits.

Boiler feedwater also is regulated automatically by a sensitive thermo-hydraulic control system which keeps in step with steam demand.

Full details about shop-assembled FM Boilers with steam capacities of 2900 to 28,000 lb per hr are given in Bulletin G-76. Write for it! *The Babcock & Wilcox Company, Boiler Division, 161 East 42nd St., New York 17, N. Y.*

BABCOCK & WILCOX
BOILER DIVISION

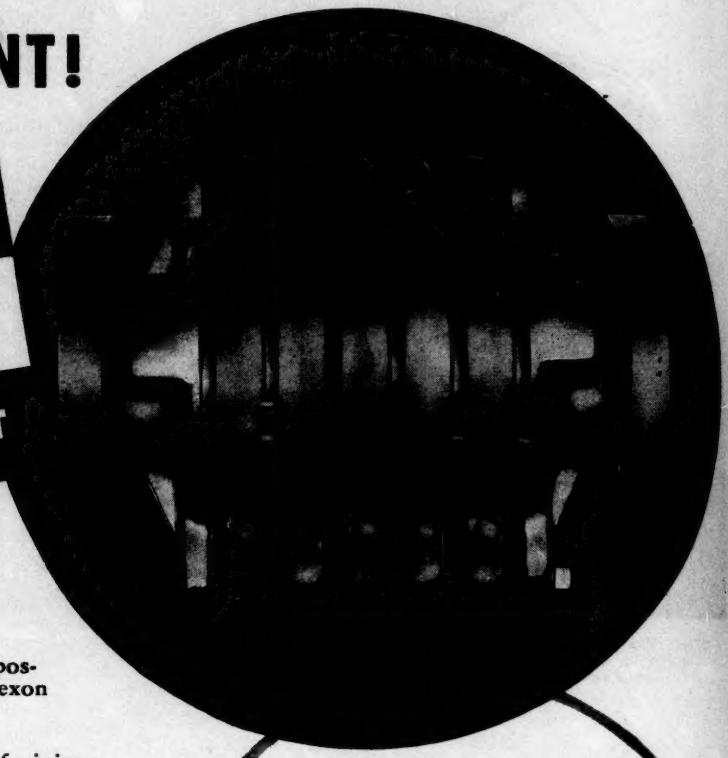
G-566

# Now you can have GREATER PIPE LINE MOTION CONTROL IN A MORE COMPACT, LESS COSTLY EXPANSION JOINT!

THE NEW

**FLEXON**

EXPANSION JOINT



Continuing research and development at Flexonics Corporation have now made it possible to offer design improvements in Flexon Expansion Joints that provide three basic advantages:

1. The face-to-face (over-all) dimension of a joint to handle a given amount of expansion has been reduced.
2. The reduction in size results in a lower expansion joint cost to handle a given amount of motion.
3. Exhaustive tests prove that these joints provide a maximum of motion commensurate with optimum life.

Coupled with such accepted advantages as compactness, ease of installation and freedom from maintenance, these additional advantages make Flexon Expansion Joints the most satisfactory method of controlling pipe line motion for the majority of installations.

Complete specifications are given in the new Flexon Expansion Joint Bulletin. Check this data before you select or specify expansion joints for your plant. Write for your copy, today.

## THREE TYPES AVAILABLE

*FREE FLEXING—Available in sizes from 3" through 48" I.D. in copper or stainless steel. Suitable for pressures to 30 psi, temperatures from minus 100°F. to 800°F.*

*CONTROLLED FLEXING—(Illustrated above) Available in sizes from 3" through 48" I.D. in copper or stainless steel. Suitable for pressures to 300 psi, temperatures from minus 100°F. to 800°F.*

*FLEXONIFLEX—Integral ring type. Available in sizes from ½" pipe through 6" pipe. Suitable for pressures to 5500 psi, temperatures from minus 400°F. to 1600°F.*

**Flexonics** *Corporation*

**EXPANSION JOINT DIVISION**

1360 S. THIRD AVENUE • MAYWOOD, ILLINOIS

**FORMERLY CHICAGO METAL HOSE CORPORATION**

Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.

Manufacturers of Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems • Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

OFFICE, PLANT AND LABORATORIES
WHITE LABORATORIES, INC.
KENILWORTH, N. J.

Consulting Engineer:
A. M. Kinney, Inc., Cincinnati, Ohio
Contractor:
Frank A. McBride Co., Paterson, N. J. and New York, N. Y

KENNARD Engineered

# HEAT TRANSFER EQUIPMENT

## *was prescribed...*

. . . . to help maintain the rigid standards set by White Laboratories in their manufacture of fine pharmaceuticals, chemicals and drugs; Kennard Chill Water Coils were specified using 1200 GPM of well water and 1700 GPM of chilled water to provide 1775 tons of air conditioning, and Kennard Steam Distributing Tube Coils to provide 24,645,000 BTUs/HR of heating.

These new buildings are among the most handsome and completely modern in the pharmaceutical and drug industry.

Kennard is justly proud to blend their name with White's.

**WRITE FOR CATALOGS AND BULLETINS**

- No. 486—Air Conditioning Blower Units
- No. 494—Cooling Towers
- No. KT-1—Cooling Towers
- No. 491—Evaporative Condensers
- No. 47A—Finned Coils
- No. HV-1—Heating and Ventilating Units
- No. MZ-1—Multi-Zone Air Conditioning Blower Units
- No. SC-1—Sprayed Coil Dehumidifiers

**KENNARD CORPORATION** • 1823 S. HANLEY ROAD ST. LOUIS 17, MO., U.S.A.

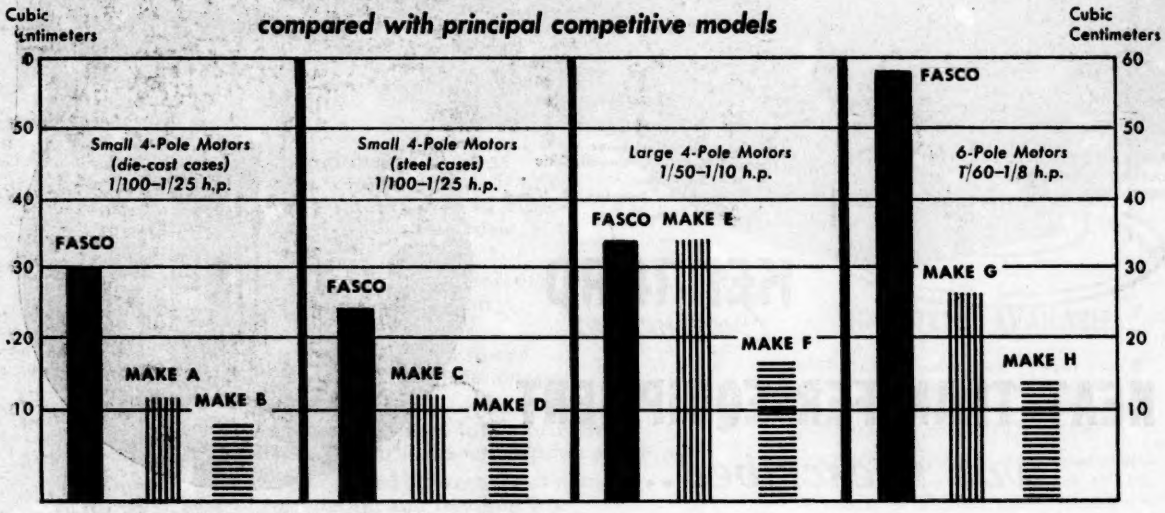
# How long is "lifetime"? What is "permanent"?

Referring to lubrication in small motors, some motormakers are using the terms "lifetime" and "permanent" a bit loosely.

Before you're intrigued by a glib phrase, let's look at some facts. Lubrication systems of FASCO Shaded Pole Motors (and competitive makes, too) include bearings, oil reservoirs, and oil. The oil does the lubricating. Assuming oversize bearings, adequate wicking of top grade, proper means of oil retention and recirculation, and the best lubricant available—then oil *capacity* determines motor life and dependable performance.

Here are the actual oil capacities of four FASCO motors compared with the principal competing makes of the same types.

**OIL CAPACITY *FASCO Motors***
***compared with principal competitive models***




That's important—as one indication of the plus values built into FASCO motors—and it's made more important by the superiority of FASCO design and materials—elements that can't be compared in a chart. But it's not the final answer in getting the right motor for your job.

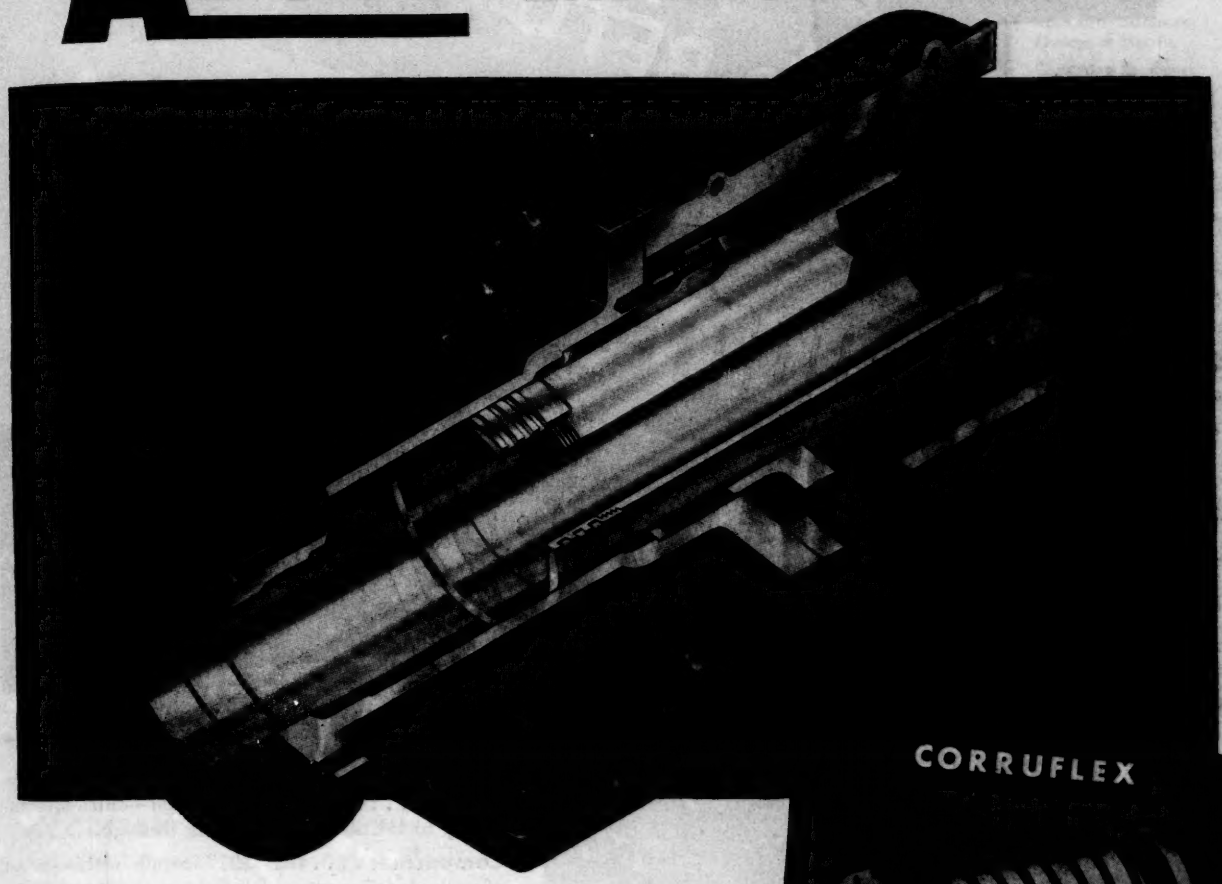
The most important factor in getting dependable performance and long motor life is *precise application.* FASCO engineers—both here and in the field—offer (and insist on) this service—to insure your getting what you want. They test your application under actual field conditions, and specify the FASCO motor that exactly fills your need.

FASCO's analysis of your motor problem will fill your requirements squarely and completely, by considering loads, duty-cycles, ambient temperatures—all the factors that influence motor performance in your finished product.

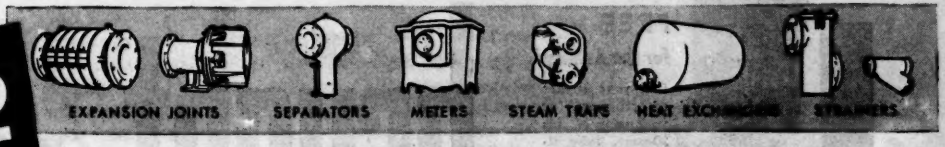
We'll be glad to prove it. Just write.

**FASCO**
INDUSTRIES, INC.
ROCHESTER 2, NEW YORK

# ADSCO EXPANSION JOINTS



ADSCO'S piston-ring expansion joints can be serviced *and* packed under full-line pressure. That's why they're best. Simple and compact, they will absorb expansion caused by temperature differential in pipes carrying liquids, gases, or steam. The high-polish surfaces of these joints can never be scored, because the slips are in contact only with packing. Misalignment is prevented by both internal and external guiding. Write for Bulletin 35-15G. Remember, only ADSCO makes all types of expansion joints. We don't have to sell what you don't want to buy.




ADSCO
75 YEARS OF LEADERSHIP

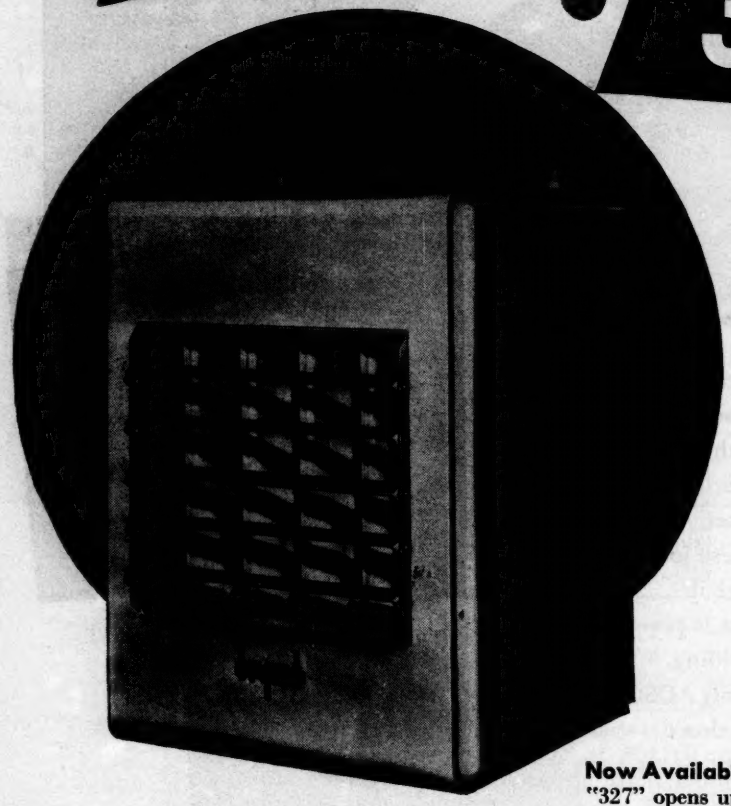
**AMERICAN DISTRICT STEAM COMPANY, INC.**
**NORTH TONAWANDA, NEW YORK**

IT'S NEW

IT'S BETTER

IT'S bryant's SENSATIONAL

"327" UNIT HEATER



## Sets NEW standards in . . .

**Quiet Operation** . . . NO narrow passages to cause whistling . . . it's open, streamlined—efficiently designed to HUSH the air flowing through.

**Compactness** . . . the "327" installs within inches of ceiling, saving space. It's lighter, easier to handle, easier to install.

**Comfort** . . . no cold blasts at start of cycle. Fan won't start until the heat exchanger is warm enough to assure comforting heat.

**Long, Trouble-free Performance** . . . the "327" retains its high efficiency for life. Efficient Venturi tubes provide longer, trouble-free service, less heat loss up the flue.

**Extra-Sensitive Controls** . . . responsive low-voltage controls mean better, more uniform heat. Safety controls prevent overheating.

**Quick, Easy Servicing** . . . easy-open access panel at bottom permits cleaning and servicing without removing unit.

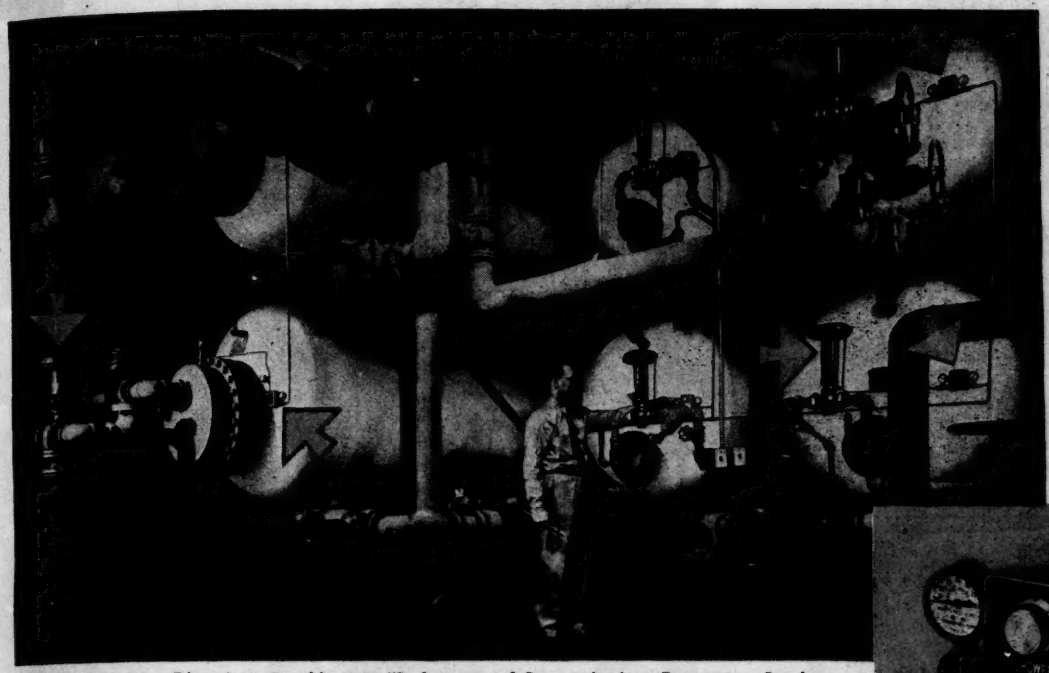
**Now Available in All Popular Sizes**—Yes, the revolutionary Bryant "327" opens up hundreds of new unit heater sales for you. See your Bryant distributor today or write Bryant Heater Division, Affiliated Gas Equipment, Inc., Dept. 146, 17825 St. Clair Ave., Cleveland, Ohio.

**FREE**
***for the Asking!***

Call your Bryant distributor for your copy of this 20-page, fully illustrated book which provides helpful information on specifying, installing and properly locating unit heaters.

bryant® *best buy in*

HEATING • AIR CONDITIONING • WATER HEATING



**WATER HEATERS AT LEVER HOUSE New York City**

Architects: Skidmore, Owings & Merrill

Consulting Engineers: Jaros, Baum & Bolles

Contractor: Gillman-Rous-Pesce Corp.

LUX TOILET SOAP

One of Lever Brothers Co. Famous Soaps

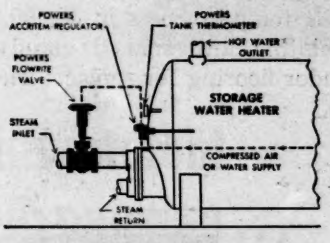
Chief Engineer Edward MacDonald states "Performance of Powers Accritem Temperature Regulators has been highly satisfactory on the 6 water heaters shown above as well as on booster heater for dishwasher and for controlling cooling of condensate before discharge to sewer."

# POWERS WATER TEMPERATURE CONTROL

**ACCRITEM Regulators** were selected for LEVER BROTHERS beautiful modern building on Park Avenue in New York City. The air conditioning system here is also Powers controlled.

Water heaters in more and more prominent buildings are being equipped with Powers Accritem Regulators because of their —

Unsurpassed for reliability and power to operate large or small diaphragm valves controlling Water Heaters, Heat Exchangers, Jacket Water Cooling for Diesel Engines or Air Compressors and many Industrial Processes.



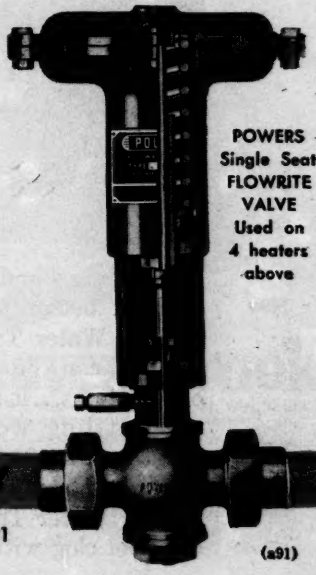
POWERS 3-Way FLOWRITE Water Mixing VALVE Used on two heaters above

## *Important Features that Give Better Control and Lower Maintenance*

- ***Adjustable Sensitivity*** and over-heat protection.
- ***Calibrated Dial*** temperature adjustment.
- ***Simple, Rugged Construction*** withstands vibration and insures years of reliable service.
- ***Temperature Ranges*** 50-250° F. and 150-350° F.
- ***Easy to Install.*** Requires 15 lb. supply of compressed air or water for its operation.
- ***Small Size***—regulator head is only 2⅞" x 3⅜", sensitive bulb is 12" long with ½" I. P. S. connection.

Bulletin 316 gives full details

***Call Powers*** for aid with your problems of temperature control. Our more than 60 years of experience may be helpful to you. Whether you want a simple self-operated regulator or thermostatic water mixing valve or a pneumatic control system with recording controllers...contact Powers.



POWERS Single Seat FLOWRITE VALVE Used on 4 heaters above

**THE POWERS REGULATOR COMPANY**

Skokie, Ill. • Offices in Over 50 Cities, See your phone book • Established 1891

(a91)

# CHASE® COPPER WATER TUBE

## Put it here!



What could be better than long-lasting Chase Copper Water Tube for domestic hot and cold water lines! It is made in hard and soft temper... straight lengths and long coils. Type L hard temper is especially suited for new construction. Soft temper comes in 40, 60 and 100′ coils that can be snaked behind walls and under flooring for replacement jobs.

## Put it here!

For underground installations there's nothing better than Chase Type K, Copper Water Tube. Type K in soft temper can be easily bent around obstructions... it moves with the earth and settling won't harm it. Long lengths up to 100 feet in coils make few fitting connections necessary. Chase Copper Water Tube resists corrosion, does not clog with rust.

Chase® BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

• *The Nation's Headquarters for Brass & Copper*

| | | | | |
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| Chicago | Houston† | Newark | Rochester† | (†sales |
| Cincinnati | Indianapolis | New Orleans | St. Louis | office only) |

# Plan Your Boiler Installation this Way..

## ...to Balance Load Factor with Low Investment
## ...to Meet Present Needs and Future Expansion...

CLEAVER-BROOKS self-contained steam boilers are the answer to both present and future steam needs. You can install Cleaver-Brooks boilers in units to fit your present steam capacity requirements . . . keeping your investment at a minimum and your boiler efficiency at a maximum. Here's how it works . . .

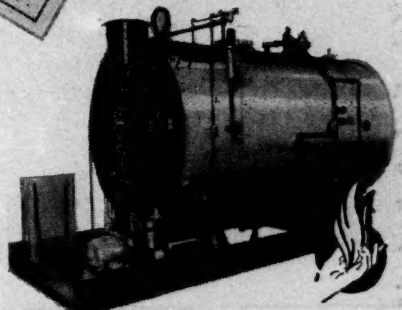
Your initial Cleaver-Brooks boiler installation is made in the size or capacity to fit your present steam load — this assures full use now at top efficiency and low capital investment.

As increased steam needs arise, additional Cleaver-Brooks boilers can be added to keep pace with your expanded requirements.

With this flexible program, you have the greatest return from your boiler investment — minimum original cost and lowest operating cost. Your boilers are always operating at maximum efficiency (80%) over the entire working range (30 to 100%).

Cleaver-Brooks self-contained boilers are ideal for multiple installations because of their compactness, low headroom requirements, fast installation, automatic operation, range of sizes. Available in standard models—15 to 500 hp.; 15 to 250 psi; gas, oil or combination gas and oil fired units.

Get all the story — write today for latest catalog.

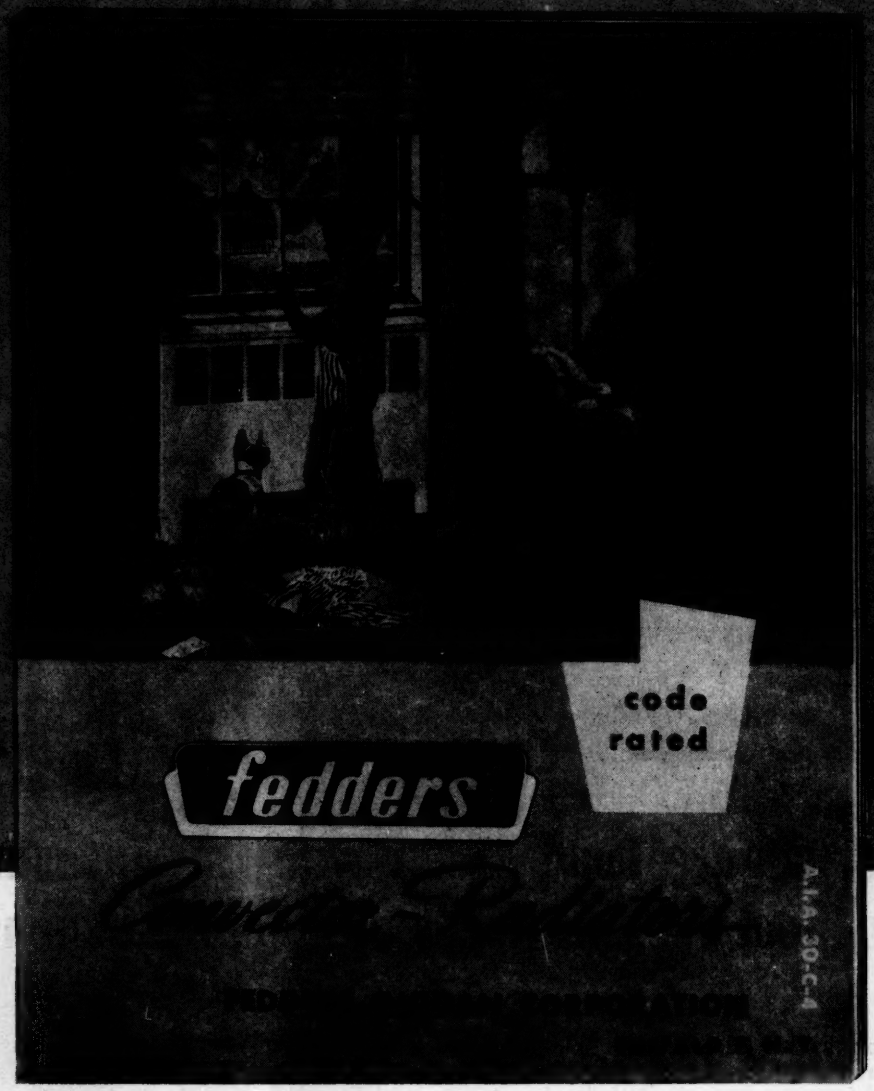


**Cleaver-Brooks**

Dept. K, 314 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
Cable Address: Clebro-Milwaukeewis

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

# EVERY HEATING MAN SHOULD HAVE

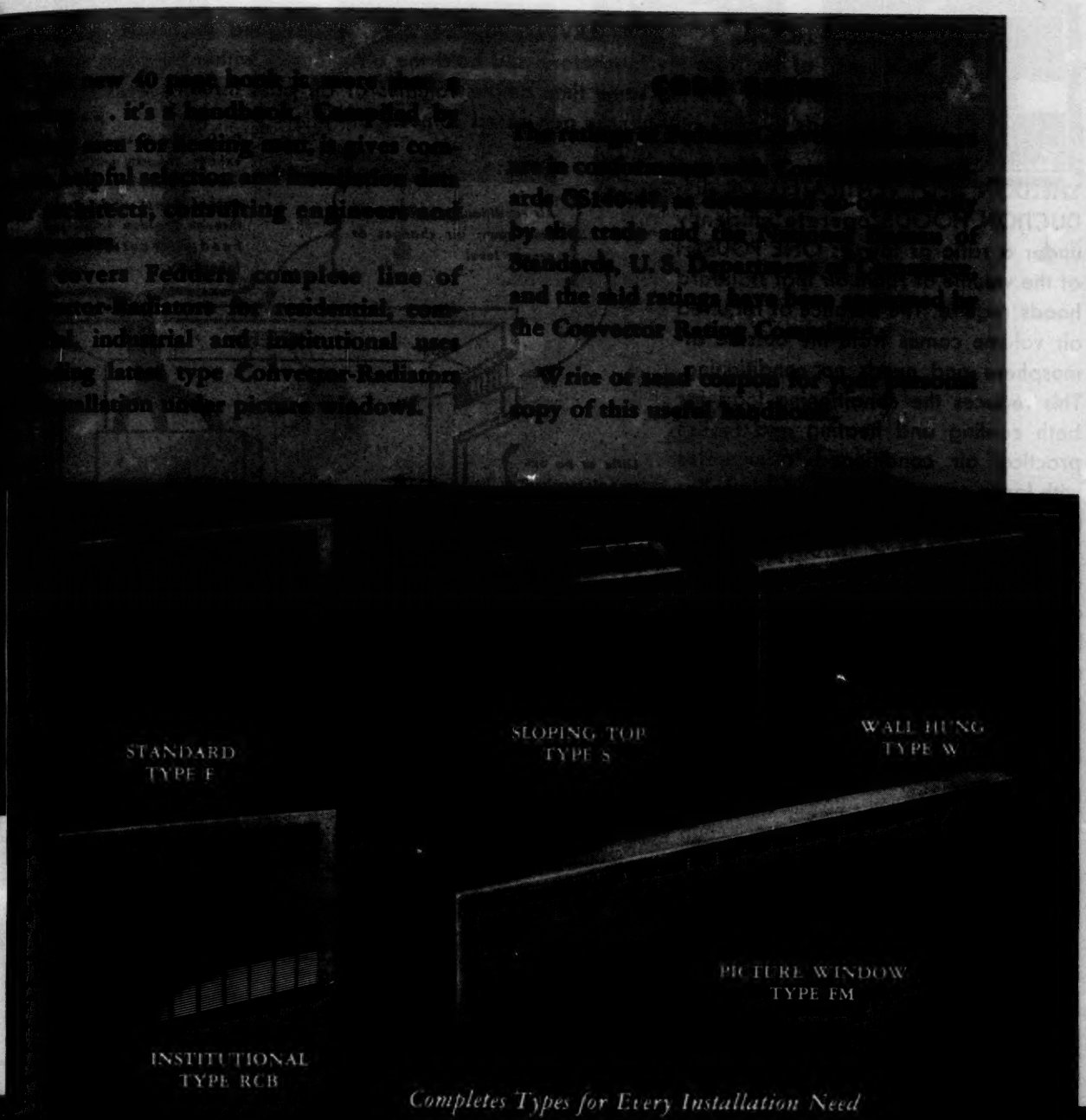



## IT'S fedders NEW AND COMPLETE CONVECTOR-RADIATOR CATALOG

**FEDDERS-QUIGAN CORPORATION**

57 Tonawanda St. Buffalo 7, N. Y.

# E THIS VALUABLE NEW WORKING TOOL




*Completes Types for Every Installation Need*

*Mail this coupon today for your personal copy*

**FEDDERS-QUIGAN CORPORATION**
**Heating Division**
**57 Tonawanda Street, Buffalo 7, N. Y.**

**Kindly send____copies of new Convector-Radiator Catalog addressed to my personal attention.**

*Name*_____

*Concern*_____

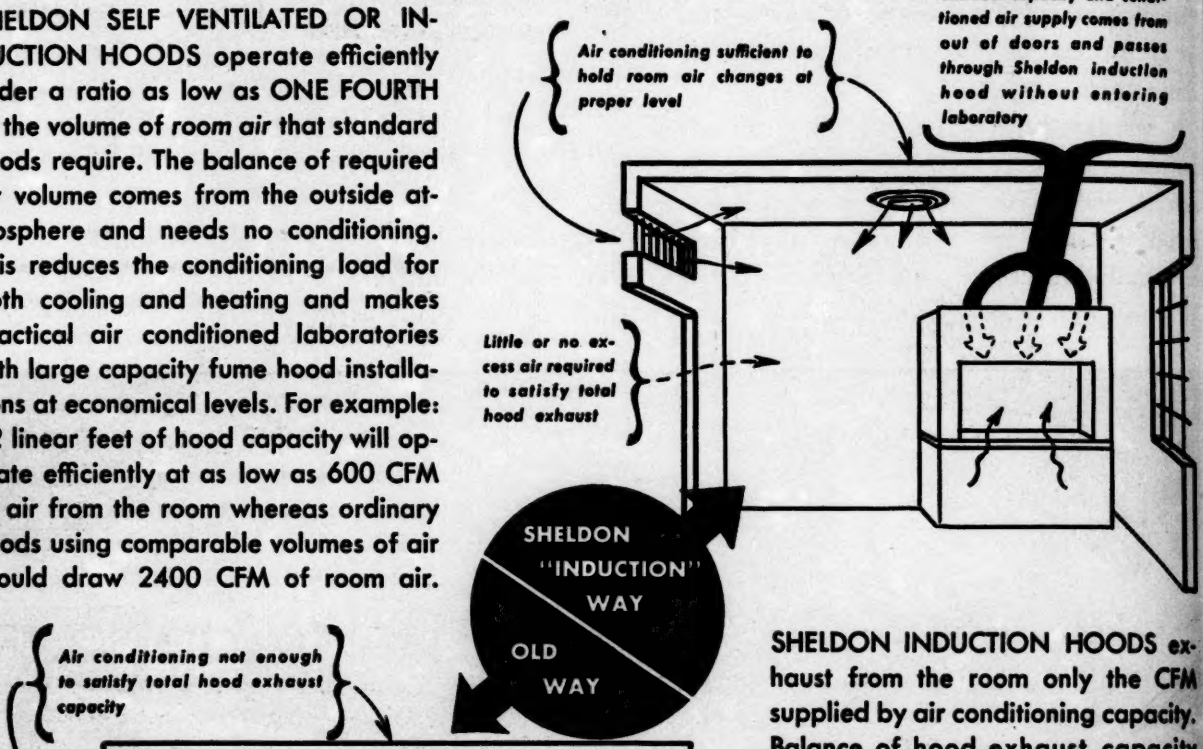
*Street*_____

*City*_____ *State*_____

# AIR CONDITIONED LABORATORY FUME DISPOSAL with SHELDON "INDUCTION" HOODS

**SHELDON HOODS FOR CONSERVING ROOM AIR** are designed to exhaust definite VOLUMES of air from the laboratory and hold the air changes within the room at predetermined levels. At the same time ample volumes of air pass thru the working area of the hoods to efficiently handle generated fumes.

**SHELDON SELF VENTILATED OR INDUCTION HOODS** operate efficiently under a ratio as low as ONE FOURTH of the volume of *room air* that standard hoods require. The balance of required air volume comes from the outside atmosphere and needs no conditioning. This reduces the conditioning load for both cooling and heating and makes practical air conditioned laboratories with large capacity fume hood installations at economical levels. For example: 12 linear feet of hood capacity will operate efficiently at as low as 600 CFM of air from the room whereas ordinary hoods using comparable volumes of air should draw 2400 CFM of room air.


Difference between hood exhaust capacity and conditioned air supply comes from out of doors and passes through Sheldon induction hood without entering laboratory
Air conditioning sufficient to hold room air changes at proper level
Little or no excess air required to satisfy total hood exhaust
SHELDON "INDUCTION" WAY
OLD WAY
Air conditioning not enough to satisfy total hood exhaust capacity
More exhaust required than air conditioning supplies
Excess air to satisfy hood must enter lab. from outside

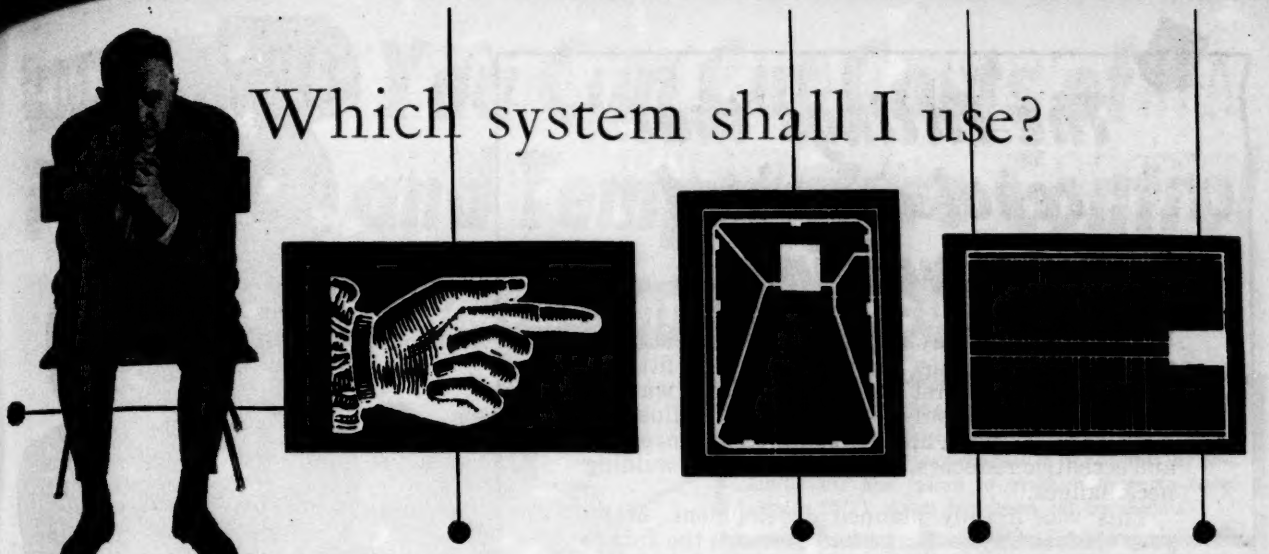
STANDARD HOODS Exhaust More Than Air Conditioning Capacity To The Room

**SHELDON INDUCTION HOODS** exhaust from the room only the CFM supplied by air conditioning capacity. Balance of hood exhaust capacity supplied by hood and does *not* enter laboratory and is *not* conditioned.

**SHELDON INDUCTION HOODS are adjustable to meet laboratory requirements. Our sales engineers will be glad to work with you on definite installation requirements. Write or wire Muskegon, Michigan, for the nearest sales office and engineer.**

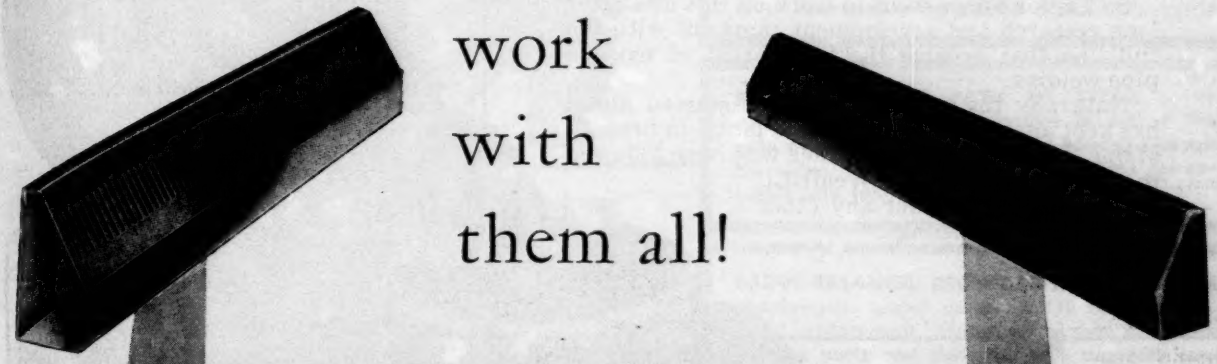
## E. H. SHELDON EQUIPMENT COMPANY

MUSKEGON, MICHIGAN



# Which system shall I use?

# Standard's perimeter baseboard registers work with them all!



***for loop, lateral, crawl-duct, and all other systems, they're best!***

Standard's Perimeter Baseboard Registers, illustrated model C-F5, feature all the latest developments of perimeter heating and are the finest, most efficient registers on the market today. Each four-foot section has its own individually operated damper control, easily adjustable for minimum, medium, and maximum volume control. Standard's Perimeter Baseboard Registers spread warm air along the baseboards and do away with concentrated heat drafts that fade to cold spots in room interiors.

***features:***

- Each section controlled individually.
- Efficient Snap-on end caps.
- Heavy-duty construction of 20-gauge steel.
- Finished in prime coat . . . special finishes on request.
- Simplifies balancing of heating system.
- Comes in 4-foot sections with separate heat straps for continuous installation.
- Set-O-LOK feature for positive air control available at slight extra cost.

Ideal for use in homes, schools, churches, and commercial installations. Also available as C-F4. Both designs have sliding damper control. Adaptable for year-round air conditioning.

**Standard Stamping & Perforating Co.**

**3835 W. 49th Place  Chicago 32, Illinois**

For more information, and a copy of Standard's New Pocket Catalogue, showing complete line of registers and grilles, *Mail Coupon Today.*

Standard Stamping and Perforating Co. Dept. V,
3835 West 49th Place, Chicago 32, Illinois

Gentlemen: Please send me more information about Standard's Perimeter Baseboard Registers and a copy of your Pocket Catalogue, at no obligation to me.

*Name* _____

*Firm* _____

*Address* _____

*City* _____

# The fittings that revolutionized pipe welding . . .

In the year 1931 Taylor Forge gave industry its *first real line* of seamless, butt-welding pipe fittings. We say it was the first *real* line because it was the first to include not only long and short radius ells, but also full branch and reducing tees, concentric and eccentric reducers, stub ends, caps and welding neck flanges.

This was a fully planned development. Many years before Taylor Forge had foreseen the future of the butt-welding fitting . . . had realized that pipe welding could not go beyond its then crude stage until pipe users were given *all* the fittings necessary to make up complete piping systems.

So Taylor Forge went to work on this and after long research and development came out with the full line that became the inspiration of modern pipe welding.

Naturally the organization that started ahead has kept ahead . . . in design, in quality, in breadth of line. That is why so many men who have followed the development of the WeldELL line, refuse to consider any other kind of welding fittings.

T F

For up-to-the-minute facts, see your Taylor Forge distributor

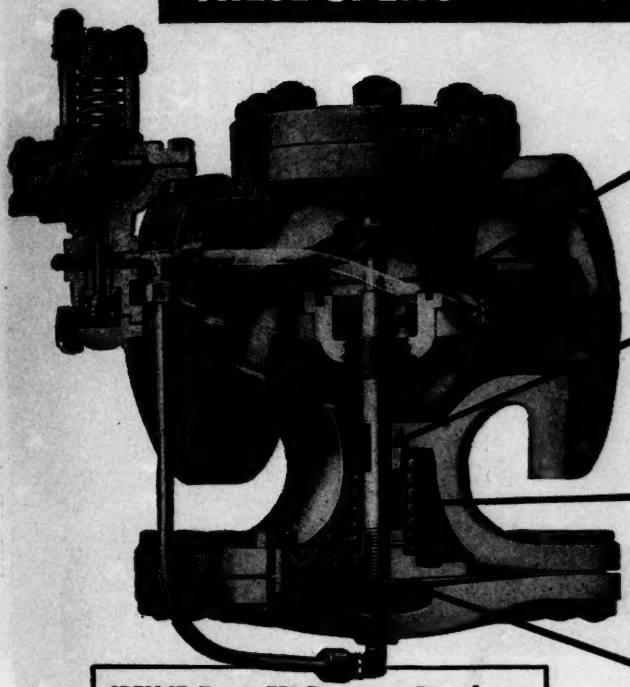
# TAYLOR FORGE

**TAYLOR FORGE & PIPE WORKS,** General Offices and Works: P.O. Box 485, Chicago 90, Ill.
*Offices in all principal cities.* Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada

HERE'S PROOF

# You Can Cut Costs of Pressure and Temperature Control

## THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

**SECO METAL SEATS AND DISCS** — Durable SECO Metal resists wiredrawing. *More than twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

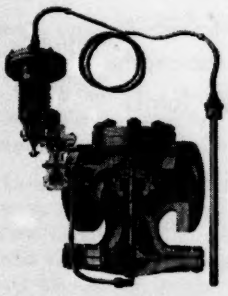
**PACKLESS CONSTRUCTION** — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

**SPRING OUT OF PATH OF STEAM** — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

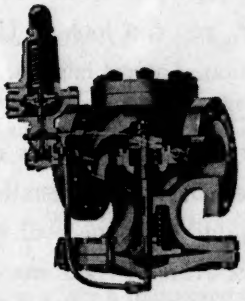
**LARGE BALANCED DIAPHRAGM**—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

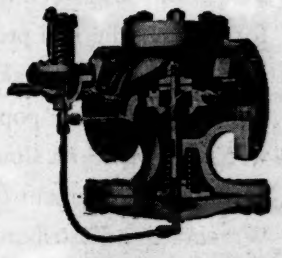
Spence Pressure and Temperature Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.



Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

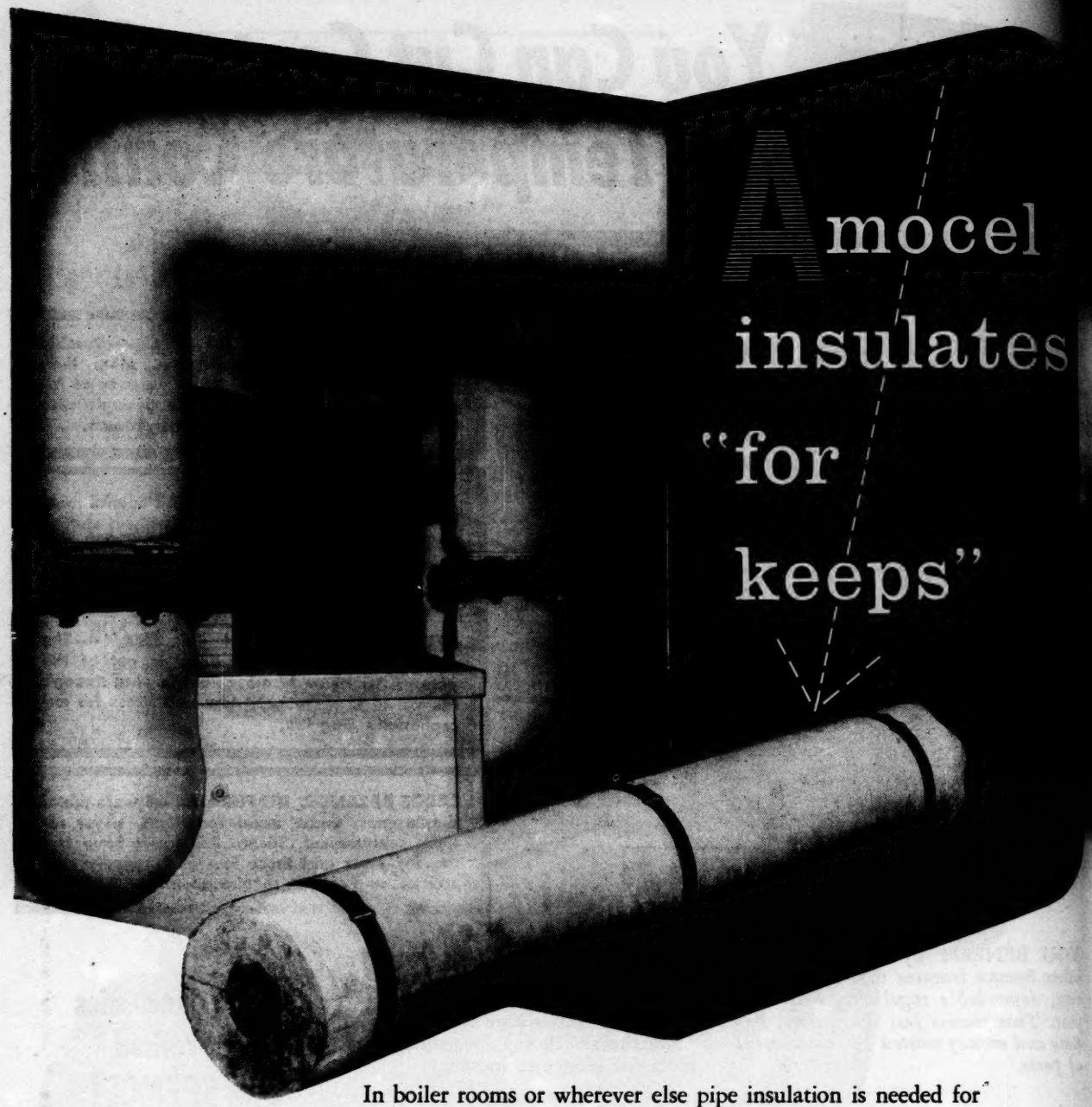
## These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

**and thousands of others**

**SPENCE ENGINEERING COMPANY INC.**
WALDEN, NEW YORK

Spence

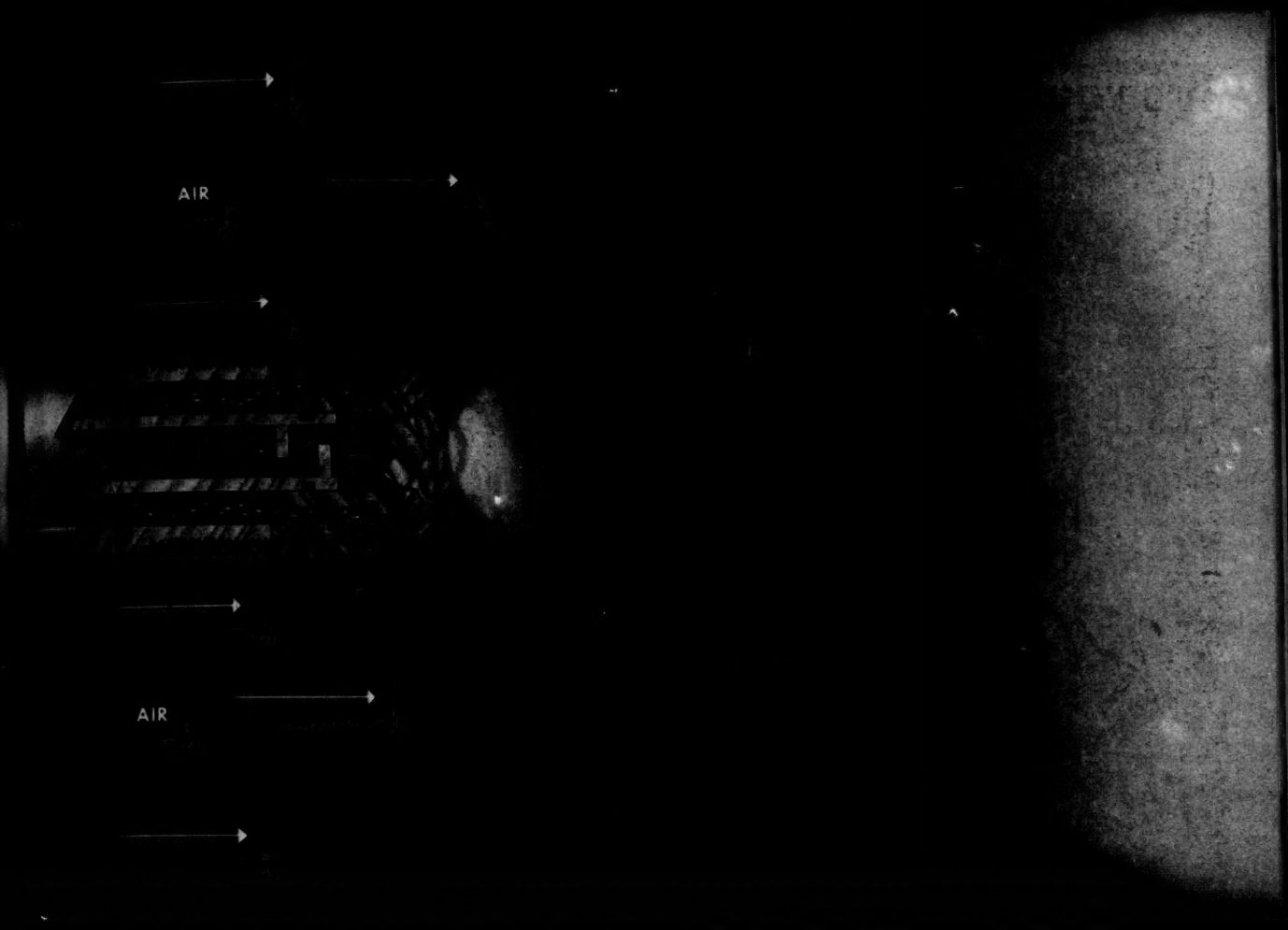



In boiler rooms or wherever else pipe insulation is needed for temperatures up to 600° F., you can look to Unarco Amocel for low-cost thermal protection. Amocel has many of the excellent features that make Unarco's higher-temperature insulation, Unibestos, so popular with industry. It's easy to apply; won't "powder" or slough-off. A normal installation lasts the lifetime of equipment or building. Phone your nearby Unarco Warehousing Distributor for Amocel from stock. Or write us for your Distributor's name and free copy of Bulletin 76-109.

UNARCO

**UNION ASBESTOS & RUBBER COMPANY**

DEPT. B-9, 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS




# NOW—only Powermaster gives you VORIFLOW combustion!

## LATEST DEVELOPMENT IN BURNER DESIGN REDUCES COSTS AND INCREASES BOILER EFFICIENCY

Here's what *Powermaster's* new VORIFLOW burner will do for you:

**1. Saves fuel by providing infinitely variable combustion modulation** in response to demand—with *full efficiency*—through wide range from 30% to 100% of firing capacity.

This means elimination of waste and maintenance headaches because of incomplete combustion. With the exclusive design of the VORIFLOW burner, tiny jets of compressed air pulverize every droplet of oil . . . projecting a fine fog of oil/air emulsion into the combustion area where it ignites and burns —immediately and completely. The VORIFLOW burner does away with outmoded mechanical spinning devices, globules of wasted oil, and gummy cleaning problems.

**2. Slashes boiler maintenance costs.**

There are *no* moving parts to wear out • There is *no* cup to clean daily. Routine cleaning of the burner once a month is sufficient • There is *no* burner vibration to throw adjustments "out of whack" • Parts are made of stainless steel, brass, and beryllium copper—they will last indefinitely.

**3. The combination burner permits rapid change-over** from one fuel to another—light oil, heavy oil, or gas.

And when we say "rapid" we mean just that—the job can be done in four minutes. Modulating firing controls are ready to go into action at the flick of a switch. It isn't necessary to change the entire burner assembly. All you need to do to fire gas is to remove the oil nozzle.

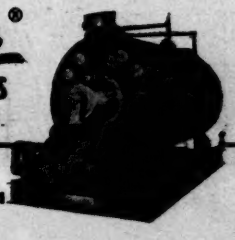
Before deciding on a boiler for your plant, be sure to get the facts on the newest POWERMASTER with VORIFLOW combustion. Write for this catalog that gives you the entire story of the *Powermaster* packaged automatic boiler. Just drop us a line and we'll put one in the mail for you.

**YOUR CUSTOMERS and PROSPECTS are reading this message. It tells why the Powermaster gives outstanding performance. We'll be glad to send you more information.**

*Powermaster*®

**PACKAGED AUTOMATIC BOILERS**

In sizes to 500 HP; pressures to 250 psi.

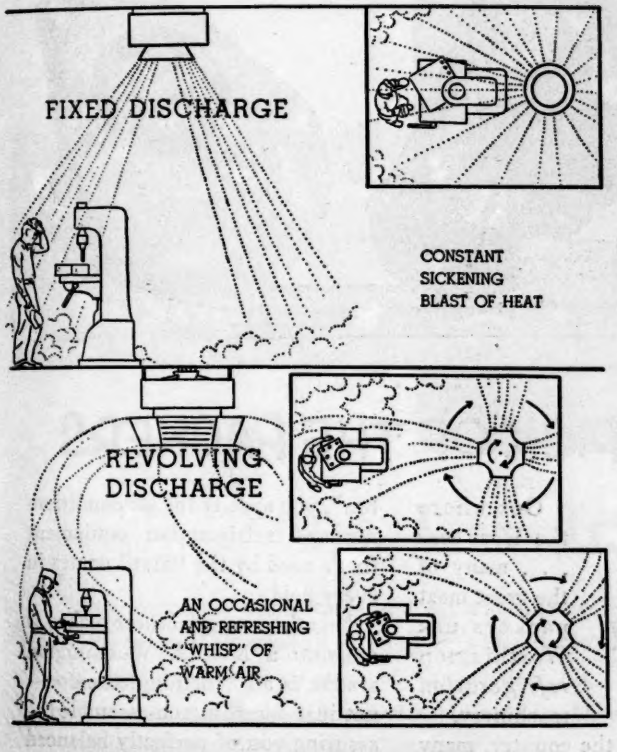


**ORR & SEMBOWER, INC.** • Established 1885 • **1000 Morgantown Road, Reading, Pennsylvania**

IT'S YOUR LIGHT OF LIBERTY KEEP IT BRIGHT

THE YOUNGSTOWN SHEET AND TUBE COMPANY
GENERAL OFFICES - YOUNGSTOWN 1, OHIO
Export Offices - 500 Fifth Avenue, New York City
Manufacturers of
CARBON - ALLOY AND YOLOY STEELS

# The BIG difference between "revolving" and "fixed" unit heaters . . .




WING Revolving Unit Heaters are successfully solving the heating problems of thousands of industrial plants today because they assure a uniform, comfortable temperature throughout, with no hot blasts, no cold spots, no chilly corners. Instead of annoying hot blasts, the worker is conscious only of a pleasing sensation of fresh, live, invigorating warmth . . . and in summer, with the steam turned off, the revolving "heaters" become an equally efficient cooling system.

**L. J. Wing Mfg. Co.**

**158 Vreeland Mills Road, Linden, N. J.**

In Europe: Etab. WANSON, Haren-Nord, Brussels, Belgium

*Factories: Linden, N. J. and Montreal, Canada*

***Write for a copy of Wing Bulletin HR-6, which discusses in detail the problems of industrial plant heating and in particular the value of revolving discharge.***

**Wing**

REVOLVING UNIT HEATERS

**L. J. Wing Mfg. Co.**

**158 Vreeland Mills Road, Linden, N. J.**

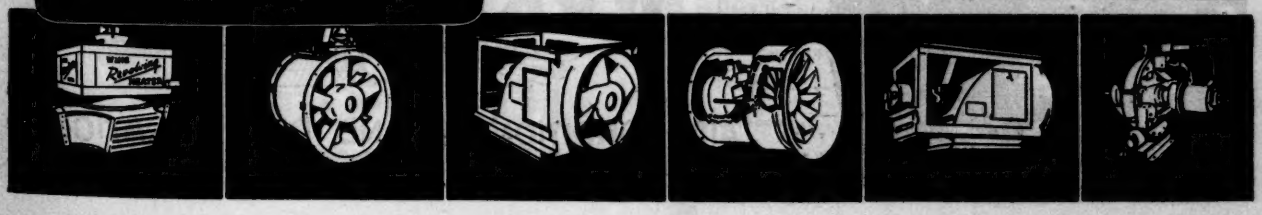
Please send me a copy of your Bulletin HR-6, Wing Revolving Unit Heaters.

NAME.....

FIRM.....

ADDRESS.....

CITY.....ZONE.....STATE.....



# THE PICK OF THE PACKERS



Out where the West *ends* . . . many of the great meat packers use Worthington *refrigeration* machinery.

And all over the country, many famous *restaurants*—Toffenetti's in Times Square, Silver Fox Restaurant in Washington, The Century Room, Dallas—use Worthington *air conditioning machinery*.

When you specify "Worthington", you specify the air conditioning and refrigeration equipment that's used by the "first" names in every field.

No other manufacturer makes *so complete* a line. A Worthington system is all Worthington-*made*—not just Worthington-assembled—assuring you of perfectly balanced operation and unit responsibility.

Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey.

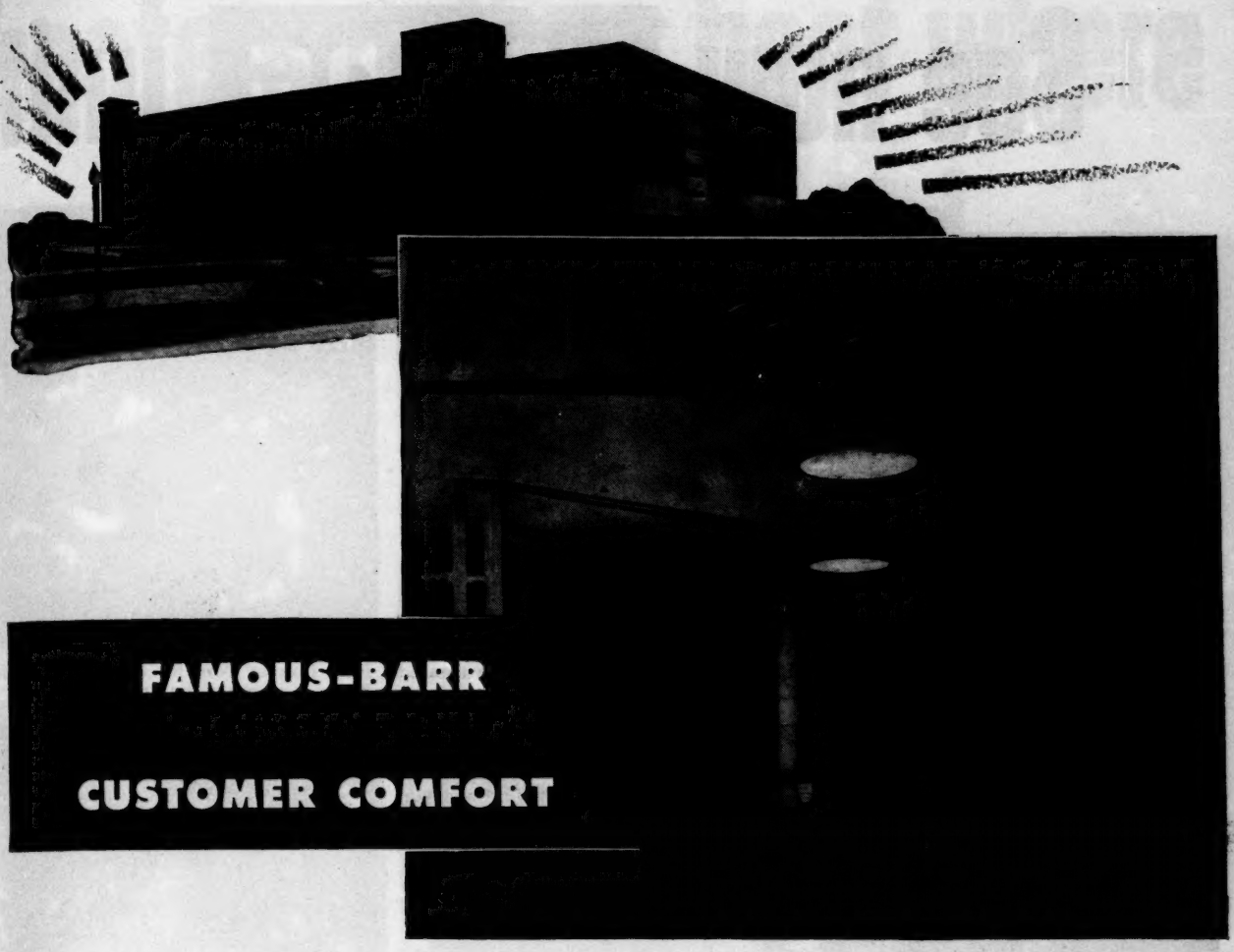
America's Leader's... in Many Businesses... Select

**WORTHINGTON**

A.2.11

**AIR CONDITIONING AND REFRIGERATION**

**The Most Complete Line... Always the Correct Recommendation**




# with kno·draft adjustable air diffusers

Keep customers comfortable and department store sales go up. That's been proved time and again. So, in the new Southtown store of Famous-Barr Co., St. Louis, you'll find Kno-Draft *Adjustable* Air Diffusers.

Kno-Draft *Adjustable* Air Diffusers can be set for exact control of both volume and direction of air flow. This means even distribution of heat, *without drafts*, throughout the conditioned area. And because they are adjustable *after* installation, it's no trouble to vary the air pattern when changed conditions call for it. This feature also eliminates much preliminary figuring by engineers and installers — makes a foolproof system.

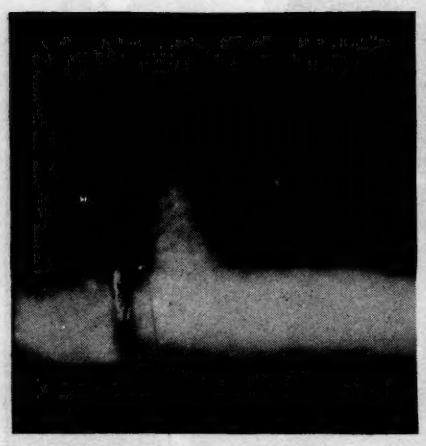
Note, too, the handsome appearance of Kno-Draft *Adjustable* Air Diffusers. They are as unobtrusive as they are efficient — go with any surroundings, either in their natural spun metal finish or painted to match the ceiling. There are types and sizes to meet every need. Mail the coupon for full information today.

kno·draft®
adjustable air diffusers

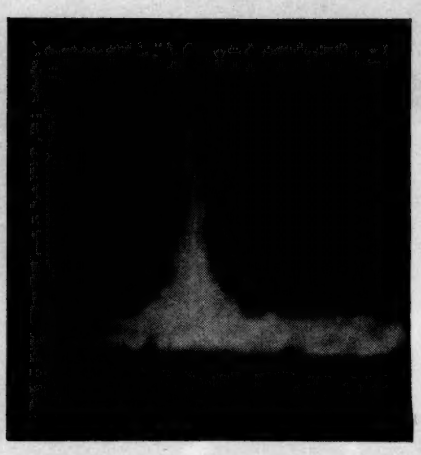
W. B. CONNOR ENGINEERING CORP.
Dept. J-92, Danbury, Connecticut
Please send me the *new edition* of the Kno-Draft Data Book—without obligation, of course.

Name.....
Position.....
Company.....
Street.....
City.....Zone.....State.....

# See how TRANE unit



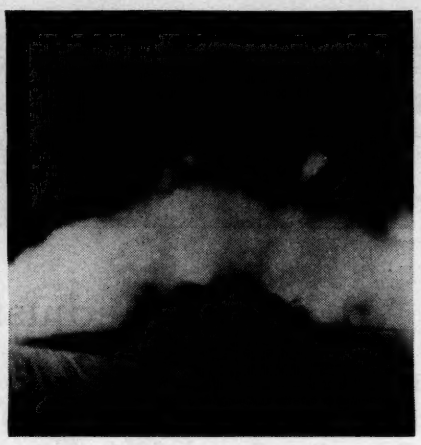
Projection Heater without diffuser sends ceiling heat to floor.



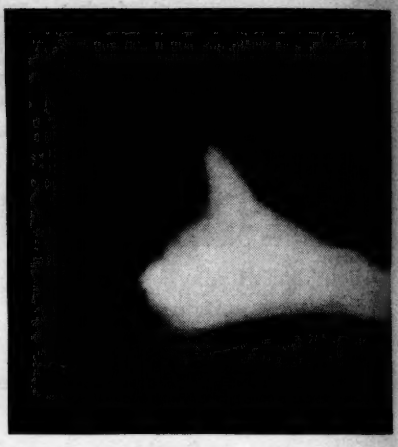
Straight-down stream with patented Louver Cone gives 60% extra throw.

Here Louver Cone forces heat down and floods it over a wider area.

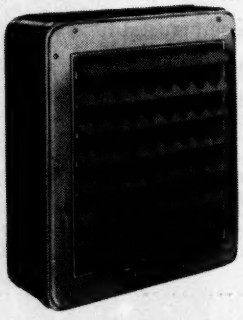
Horizontal Unit Heater with Louver Fin diffuses heat in gentle blanket.



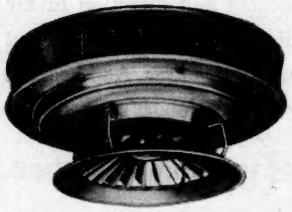
Here heat stream is "split"; thus one unit does the work of two heaters.



Louver Fin blades "toed-in" for spot heating, add up to 25% more throw.



**TRANE Model H Unit Heater** —Versatile horizontal-type heater with exclusive Louver Fin Diffuser.

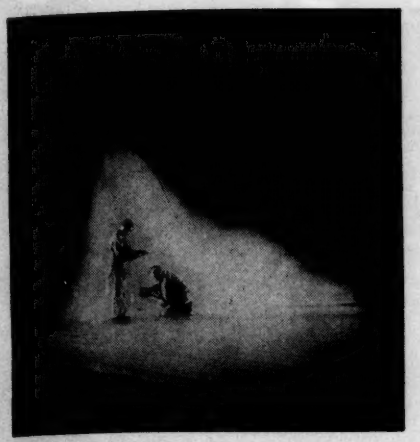


**TRANE Projection Heater** with exclusive Louver Cone Diffuser. Projects ceiling heat to floor.

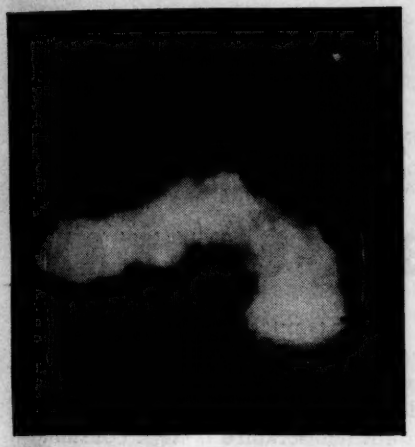
**TRANE Roof Ventilator**—Also available with heating section and dampers.

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND

# heaters deliver heat where it's wanted...



Louver Cone "spots" heat on one side, warms area without waste.

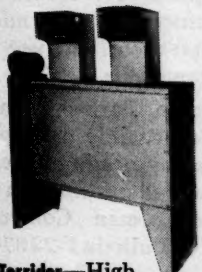


Half of heat flows ahead; balance is delivered at right angle.

**IN THESE** smoke tests you can see how TRANE Unit Heaters put the right *amount* of heat . . . right *where* you want it. And these are only *two* unit heaters from the complete TRANE line. You can actually choose from *six different models*, in dozens of sizes, to handle any heating problem.

For instance, the TRANE Projection Heater is ideal for high ceiling installations . . . and craneways, aisles and bays. For heavy-duty heating jobs in one big area or with duct work, use the TRANE Torridor. Ventilation problems are simplified with a powered TRANE Ventilating Heater. There's the TRANE Force-Flo Heater for lobbies and offices . . . and the TRANE Horizontal Unit Heater for heating smaller rooms. Or if gas is available, use the all-new TRANE Gas Fired Unit Heater. It's the most rugged gas unit heater ever built.

These six TRANE Unit Heaters, together with two patented diffusers, give you the *right combination* for any unit heater application. See your nearest TRANE sales engineer for details, or write TRANE, La Crosse, Wisconsin.



**TRANE Torridor**—High volume blower-type unit; available in 5 models.

**New TRANE Gas Unit Heater** Built like a boiler; 6 sizes.

**TRANE Force-Flo Heater**—Deluxe, powerful cabinet-type heater.

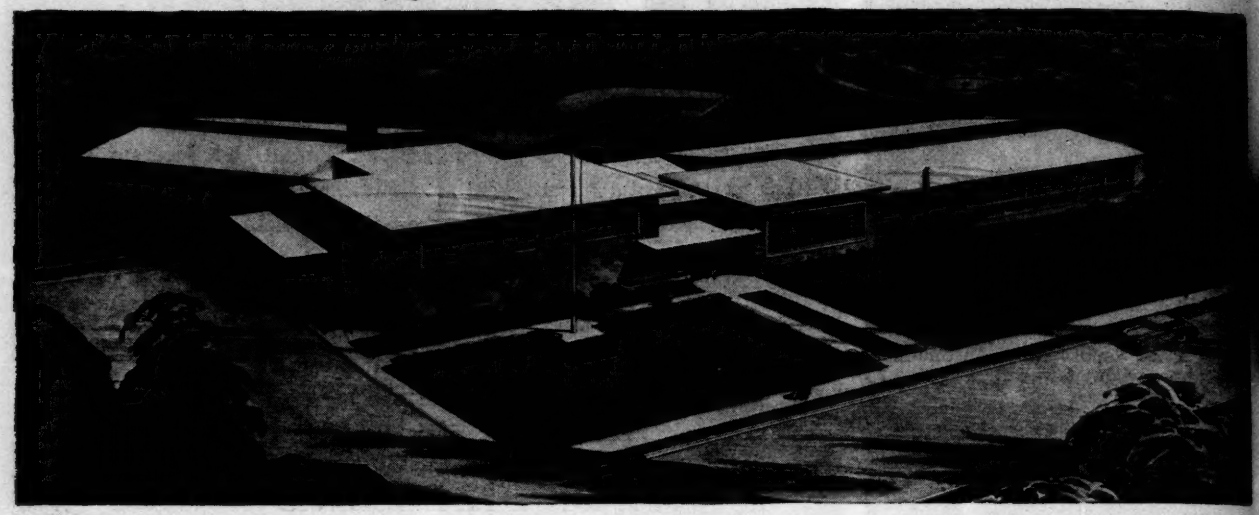
**TRANE Bucket and Float Traps**—Matched for perfect service with TRANE Unit Heaters; for either high or low pressure.

**TRANE**

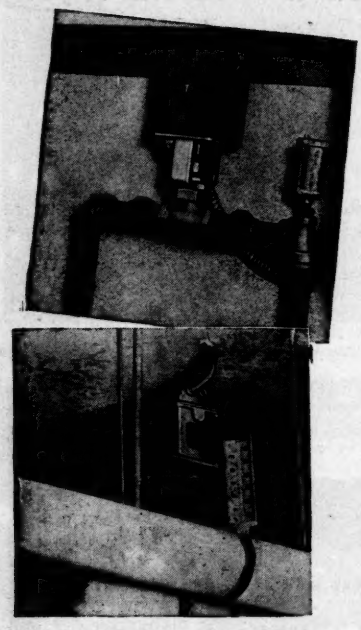
THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd., Toronto
Offices in 80 U.S. and 14 Canadian Cities

AIR CONDITIONING EQUIPMENT

# THE A B C OF PROPER *Automatic* TEMPERATURE CONTROL



OAKRIDGE SCHOOL, ARLINGTON, VIRGINIA
ARCHITECTS: Allen J. Dickey & John Graham, Jr. Arlington, Va. ENGINEER: A. Dee Counts. Washington, D.C. HEATING CONTRACTOR: W. J. Baumbach, Inc., Arlington, Va.



Above, Barber-Colman Motor-Operated Valve as installed on the hot water supply to each room.

Below, Barber-Colman Motor-Operated Valve on the steam supply to converter in the boiler room.

## ALWAYS BARBER-COLMAN

THIS is *fundamental* with experienced heating and ventilating engineers: the A B C fact that Barber-Colman controls are at the top of the roll-call.

In the modern Oakridge School at Arlington, Virginia, Controls by Barber-Colman were installed to provide a good, efficient, heating and ventilating system with flexibility. Panels supply a steady, even flow of warmth with no drafts. Rooms are grouped by zones with a fan system in each zone to assure a constant flow of filtered, tempered air for ventilation and maximum comfort. Fans are shut down at night.

Water temperature, from the converter on the oil-fired steam boiler, is varied automatically by an outdoor reset thermostat. Individual room temperature is kept constant and over-runs avoided by use of anticipating thermostats and motor-operated valves. Since system supply water temperature varies with outdoor temperature, corridors are kept comfortable with minimum heat losses without use of valves and thermostats.

So, once again Barber-Colman Controls make possible a simple, cost-saving heating system. For detailed information on Barber-Colman Controls, write for Bulletin F-2287-3.

BARBER COLMAN

BARBER-COLMAN COMPANY, 1224 ROCK ST., ROCKFORD, ILL.

ROCHESTER GAS & ELECTRIC SPECIFIES . . .

# GUN-PAKT EXPANSION JOINTS

## USER OF GUN-PAKT JOINTS SINCE 1935 ORDERS 16 MORE FOR NEW STEAM LINE

This prominent New York State utility has been using Yarway Gun-Pakt Expansion Joints for the past 17 years. Now they have ordered 16 more (12", max. working pressure 400 psi) for a new steam distribution line in their expanding system—pretty good proof that Gun-Pakt Joints give trouble-free, economical service.

Central station heating plants, institutions and industrial plants all over the country are finding Gun-Pakt Joints offer *maximum protection* with *minimum maintenance*. Gun-Pakt Joints are *rugged, strong* joints. They offer freedom from shutdowns because they are *serviced under full steam pressure*. Maintenance costs are low; one utility that kept accurate records found their maintenance costs to be only 65c per year per joint!

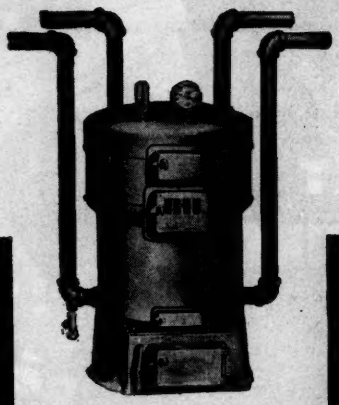
To service a Gun-Pakt Joint you simply insert a plug of packing, twist a wrench, and the joint is tight . . . the job done . . . all without taking pressure off the line.

Yarway engineers, conveniently located near you, are constantly working for better, more profitable steam plant operation. Call on your Yarway man for friendly, helpful advice.

Yarway Gun-Pakt Expansion Joint installed in Rochester Gas & Electric Corporation's Broad St. subway line, 12" joint, 350 lbs. pressure, 450°F.

**YARNALL-WARING COMPANY**
104 Mermaid Avenue, Philadelphia 18, Pa.
*Branches in principal cities*

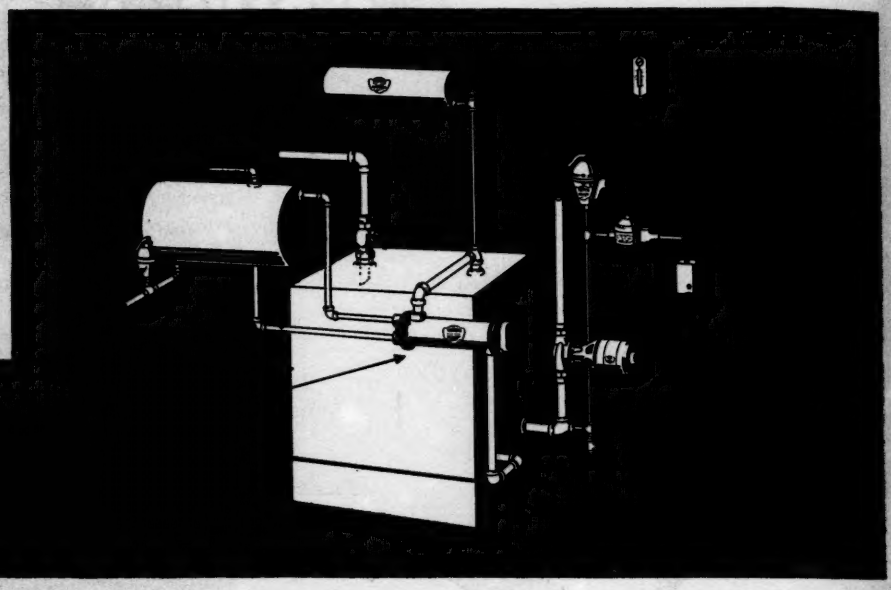
YARWAY SERVICE GOES ALL THE WAY . . .



There are many old installations like this in every community just waiting for you! Go after them with a Thrush modernization plan.

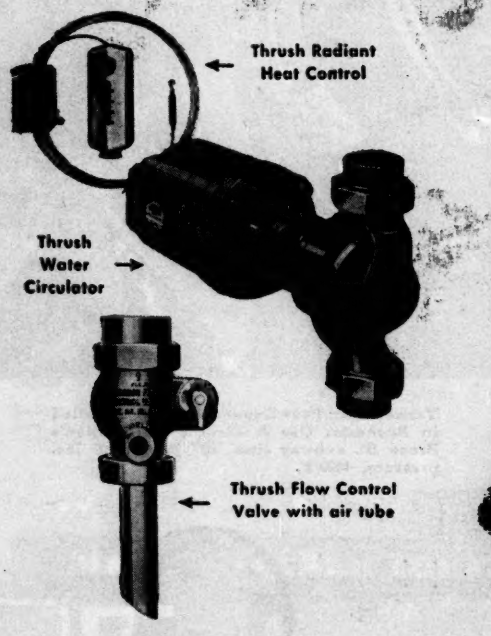
# *Modernize* old heating plants now . . . with Thrush Equipment

**Any hot water heating system can be converted easily into a modern, forced circulating heating plant with a few inexpensive Thrush units.**



# THRUSH . . .

## Flow Control System of Radiant Hot Water Heat!




**THRUSH Flow Control System installed on old hot water heating plants gives controlled comfort in every room in the house. Many homeowners would modernize if they knew it was possible to convert to a modern system at such moderate cost. A Thrush Water Circulator with Thrush Flow Control Valve will provide positive circulation without overheating. Thrush Water Heater will assure a plentiful supply of domestic hot water from the same boiler in summer and the whole year through. If you are not now installing Thrush equipment, see your wholesaler or write Department D-9.**

**H. A. THRUSH & COMPANY**

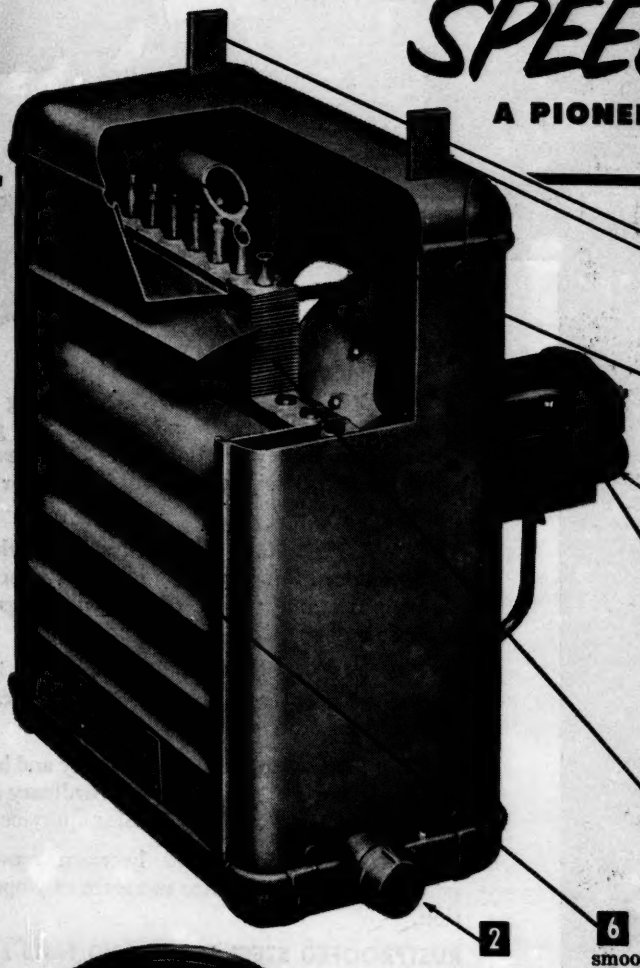
PERU • INDIANA

# COMPARE EVERY POINT...

## AND YOU'LL CHOOSE WESTINGHOUSE

# SPEEDHEATERS®

**A PIONEER NAME IN UNIT HEATERS**



**1** *Handy Hangers*—Easily-formed, pliable steel hangers furnished at no extra cost.

**2** *Piping Connections*—On either side. Supply and return lines can be connected to whichever side is most convenient for installations.

**3** *Dependable Westinghouse Motor*—Quiet running, totally enclosed motors. Low starting current and resilient mountings make them ideal for Unit Heater duty.

**4** *Motor Service Plan*—Replacement motors are available on exchange basis from 36 Westinghouse stocking points across the nation.

**5** *Single Row Radiator*—Means less air resistance; longer heat throw; more comfortable leaving-air temperatures.

**6** *Fast Heat Delivery*—Fan designed for smooth flow of large air volume; gives fast heat, quiet operation at lower power costs.

**THE DOWNBLAST SPEEDHEATER** is tops for high ceiling installations. It forces warm air *down* into working areas where it is needed.

Compare them all, on every point. Get the inside story . . . check for yourself the fast, economical heat delivery that Speedheaters offer at no extra cost. You'll find that Speedheaters are *right* for your needs, give you the *most* for your money, are the *finest* you can buy.

Speedheaters are available in 82 standard heating capacities ranging from 25,000 to 400,000 btu. For complete information contact your local Westinghouse office or write to Westinghouse Electric Corporation, Air Conditioning Division, Hyde Park, Boston 36, Mass.

**YOU CAN BE SURE...IF IT'S Westinghouse**

J-80276

TUNE IN ON HISTORY! Only Westinghouse brings you complete coverage of four-month political campaign over CBS television and radio.

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for
EASIER INSTALLATION
and
LONGER SERVICE

# KENNEDY

## JOB-FITTED

## IRON-BODY WEDGE GATE VALVE

**BUY FROM YOUR LOCAL DISTRIBUTOR**

**YOU SAVE TIME AND MONEY** all along the line with Kennedy iron-body wedge gate valves because they are JOB-FITTED . . . every valve specially designed and engineered for the job it has to do.

**THE WEDGE DISC** is a cored casting of thick metal section, reinforced by integrally-cast interior posts and provided with openings to drain in any position.

**HEAVY BRONZE DISC RINGS** are forced into dovetailed grooves in the disc in a practically inseparable construction.

**HIGHER STRENGTH IRON** in the body and bonnet is actually 50% stronger than ordinary cast iron . . . and far exceeds A.S.T.M. requirements.

**ALL CONTACT SURFACES** between moving parts are bronze-to-bronze to assure easy operation.

**RUSTPROOFED STEEL BOLTS AND NUTS** have ample clearance to prevent distortion. Open-end wrenches may be used . . . no need for special tools. Valves can be repacked under full pressure.

**EVERY FEATURE** of the valve helps it do the job better—gives you a solid guarantee of economy and dependability whenever you install one of these Kennedy Job-Fitted Wedge Gate Valves.

**WRITE FOR BULLETIN 107**

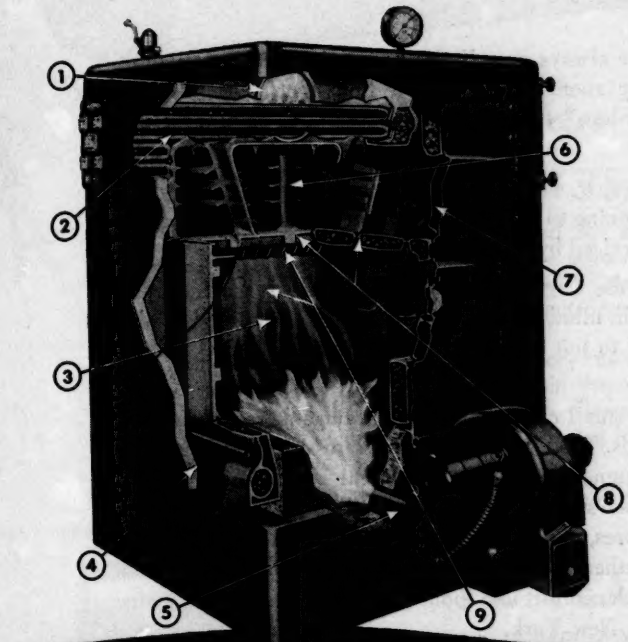
KENNEDY JOB-FITTED VALVES

**THE KENNEDY VALVE MFG. CO.**
**ELMIRA, NEW YORK**

VALVES · PIPE FITTINGS · FIRE HYDRANTS

# AMERICAN-Standard
HEATING

## Engineered to solve the heating problems of larger homes




Features That Assure
Dependable Fuel-Saving Operation

# Exbrook Boiler

FOR OIL OR STOKER FIRING

● Designed exclusively for automatic firing with coal or oil, the Exbrook is ideally suited for larger homes, or small to medium sized apartment and other buildings. Made of durable cast iron to give long-lasting service, this efficient boiler is noted for its dependable operation. A careful check of the features listed below will show you why the Exbrook may be just the answer to your heating problems. The Exbrook and other larger-than-average-capacity boilers in the American-Standard line are sold through selected wholesale distributors to heating contractors.

**1. EXTRA LARGE NIPPLES**—extend below water line and assure free and rapid circulation of boiler water and quick heat response. Also permit use of a built-in or external water heater.

**2. BUILT-IN WATER HEATER**—Tank or tankless type is available on oil boilers at small extra cost for providing year 'round hot water.

**3. COMBUSTION SPACE**—adequate in size, correctly proportioned and air-tight for burning fuel efficiently and economically.

**4. INSULATION**—suitable insulating material underneath attractive metal jacket helps prevent heat loss and keeps jacket cool.

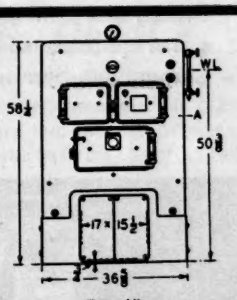
**5. OIL BURNER**—a perfectly matched, flange mounted Arcoflame Oil Burner with its famous fuel-saving "sunflower" flame, is shown. Base plate also permits easy installation of stoker.

**6. MULTI-FINNED FLUES**—provide long flue travel with maximum surface for extracting available heat from hot gases, for peak efficiency and economy.

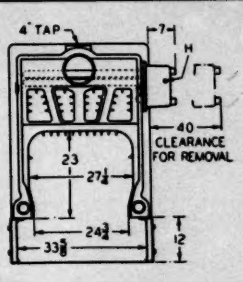
**7. STURDY, HEAT-PROTECTED DOORS**—clean-out and fire doors of heavy construction have cast iron baffle linings to protect them against warping.

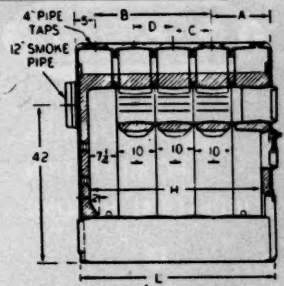
**8. TIGHT JOINTS**—where sections and doors contact other surfaces they are machine ground to form tight joints and close fit. This prevents short circuiting of gases, uncontrolled infiltration of air and escape of odors.

**9. DIRECT HEATING SURFACE**—ample finned heat-absorbing surface exposed directly to fire, for extra efficiency.




## OUTLETS • INLETS • DIMENSIONS




**American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pa.**

*Serving home and industry*

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# Want a look at the overalls picture?

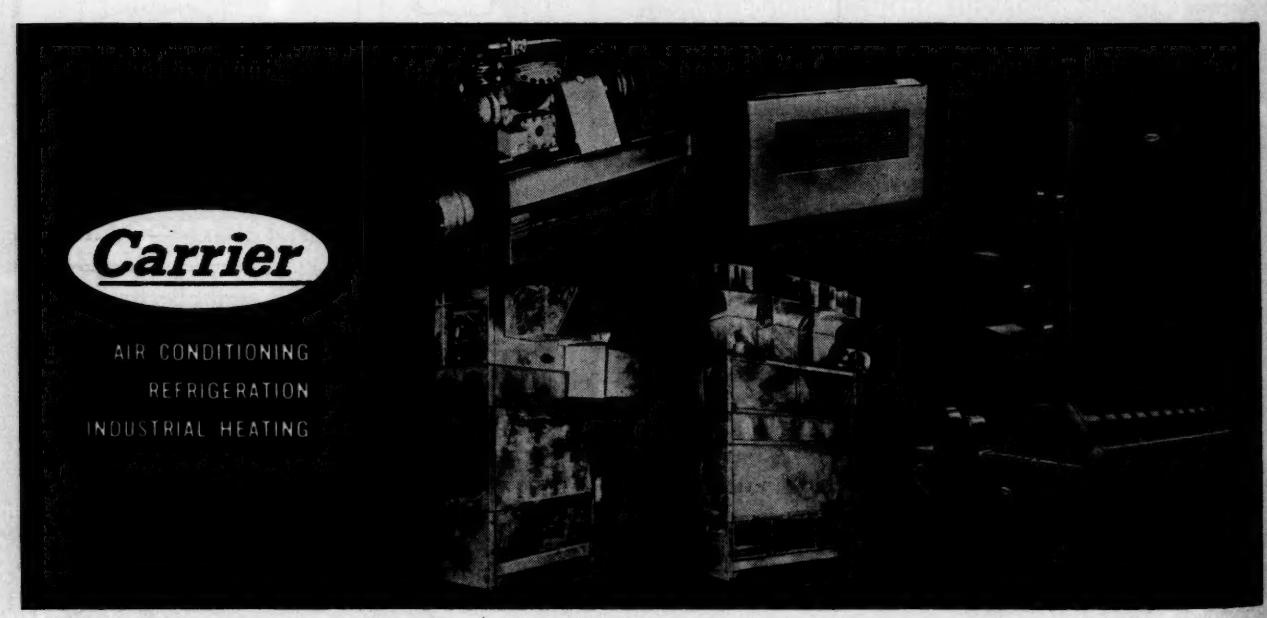
When we build the equipment you sell, we figure the Overalls Factor to be mighty important.

That's why there are always overalls in the Carrier picture. In all departments from drafting room to production line, there are men who have that certain "know-how" they got by working with equipment in a variety of applications.

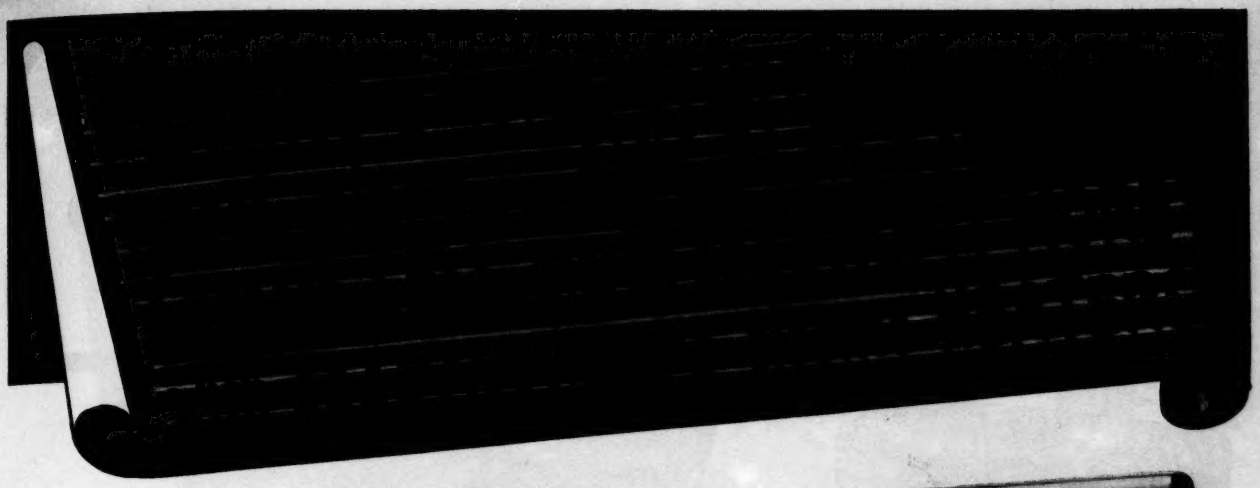
It's only with their experience behind us that we can design and manufacture equipment that's going to do the job for your customers . . . that can be easily installed and serviced by you.

That's what makes the Carrier line so exceptional. It's a family of products built with you in mind . . . a family of products matched in size, performance and quality to put the most flexible air conditioning tools in your hands.

For instance . . . for small or medium size buildings there's a choice of systems to meet your needs. There's the Carrier low-pressure Weathermaster duct system with its volume control for individual rooms. And, for air conditioning the larger open spaces of multi-room buildings, such as meeting and assembly rooms, stores, restaurants and the like, there's the Carrier System and Zoning Weathermakers—each sectionalized to be fitted into your requirements for both comfort and industrial air conditioning. Carrier Corporation, Syracuse 1, New York.

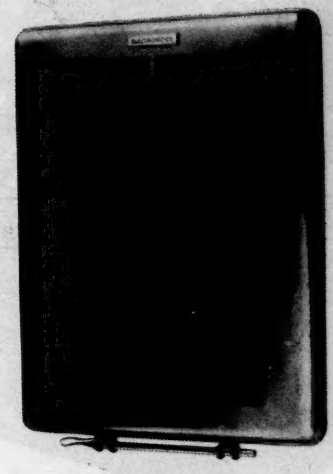



REFRIGERATING COMPRESSORS DUCT WEATHERMASTER SYSTEM WEATHERMAKERS
EVAPORATIVE CONDENSERS COLD DIFFUSERS ZONING WEATHERMAKERS



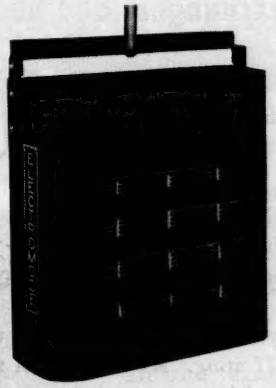
# *New Design*

## For HOMES, OFFICES, MOTELS, STORES



Completely redesigned and pre-tested for color, appearance, easy maintenance, convenient controls and heating efficiency, Electromode Automatic Wall Heaters include these user-wanted features. Famous Electromode safety and quality features have been retained . . . cast-aluminum heating element, steel cabinet, factory oil-sealed motor, and power cut-off safety switch. Built-in thermostat permits individual room temperature control. Down-Flo principle circulates heat at floor level. Easy to install in new building or remodeling.

Automatic Down-Flo Model WA 1500 to 4000 watts

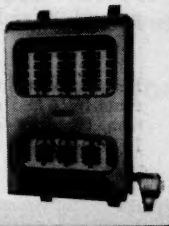


## For PLANT, OFFICE, WAREHOUSE

For any plant or office heating problem, any hard-to-heat area, choose Electromode Unit Space Heaters. These all electric heaters are available in all sizes and capacities from 1500 to 45,000 watts to fit any heating problem. They can be located anywhere that electric wiring can be strung. Equipped with automatic temperature controls and built-in safety switch, means economy of operation and absolute safety from fire, shock or burn. The exclusive patented cast-aluminum heating elements will not rust or corrode. Electromodes provide an abundance of fan-circulated heat when and where it is needed. Approved by Underwriters' Laboratories and thousands of commercial and industrial plants throughout the country.

## For HAZARDOUS AREAS EXPLOSION-PROOF HEATERS

The only Electric Explosion-Proof Heater of its kind approved by Underwriters' Laboratories. Features Electromode patented cast-aluminum heating element. Specially designed for installation in hazardous areas where heat is required and danger of explosion exists. Available in 2000, 4000, 6000 watt capacities.



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. . . on Domestic, Commercial and Industrial Electric Heating, full of specifications, illustrations, installations, diagrams, and how to figure electric space heating. Send NOW—All New.

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All Electric HEATERS

## Only Modine Gas Unit Heaters give you all

# 7 BIG ADVANCES

## in store and plant heating

**. . . because only Modine builds Gas-Fired Unit Heaters with both *Stainless Steel* heat exchangers and burners**

**1** LONGER LIFE — Stainless steel construction resists rust and corrosion — adds years of low-cost service.

**2** LIGHT WEIGHT — Installation is easier — quicker—less expensive because Modines weigh far less than ordinary units.

**3** SMALL SIZE—Modine design eliminates unnecessary bulk — makes unit more compact. Less headroom is required for installation.

**4** FASTER RESPONSE — Heat delivery begins within *5 seconds* after thermostat calls for it. No wait for warm-up.

**5** BALANCED HEATING — Discharge air temperatures are correctly related to heat throw and air volume.

**6** ADDED CONVENIENCE — Thermostatically controlled Modine Unit Heaters require no labor to operate them. No fireman worries.

**7** SUMMER COOLING — Fans can be operated with gas shut off to provide controlled air circulation in hot weather.

Remember, too, when you buy Modine, you get the greatest name in Unit Heating. As a leader in the development of steam and hot water unit heaters for over 25 years, Modine can offer you a comprehensive recommendation, based on your exact needs. Modine Gas-Fired Unit Heaters are A.G.A.-approved for natural, mixed, manufactured, L.P., L.P.-air gases.

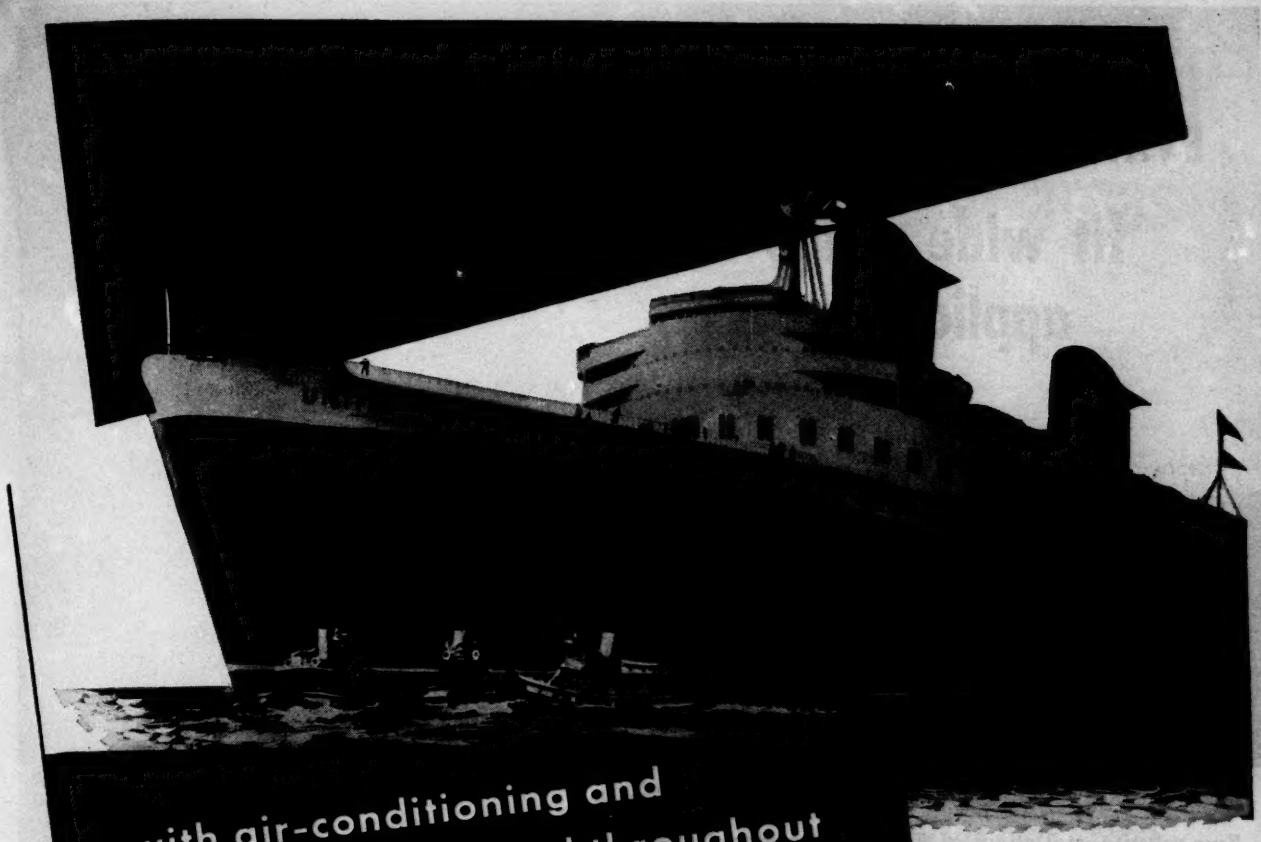
For complete information, call the Modine representative listed in your phone book classified section. Or write for Bulletin 651, Modine Mfg. Co., 1511 DeKoven Ave., Racine, Wis.

Modine also sets the pace in *steam and hot water* unit heaters — vertical, horizontal and power-throw models. These units, too, have the balanced performance that gives you uniform heating, lower fuel costs.

**Modine**

**UNIT HEATERS**

GU-11-55



# ...with air-conditioning and refrigeration controlled throughout by ALCO VALVES

990 ft. from stem to stern, the United States carries 2,000 passengers in luxury and safety. She's the first big ship ever built that is completely air-conditioned and fireproof.

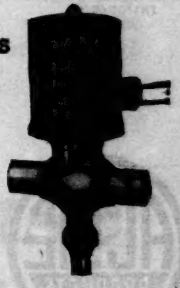
In choosing valves to control her vast air-conditioning and refrigeration systems, wise engineers turned to ALCO The reason: ALCO VALVES assure the dependable, trouble-free service required of equipment that serves at sea.

**There's a trouble-free ALCO VALVE for every application...large or small**

**THERMOSTATIC EXPANSION VALVES** Single or multi-outlet. For automatic liquid refrigerant control in all types of air-conditioning and refrigeration systems.

**EVAPORATOR PRESSURE REGULATORS** Maintain constant evaporator pressure regardless of sudden load changes.

**SOLENOID VALVES** Tight seating and packless. Moisture-proof to stop coil burn-outs.



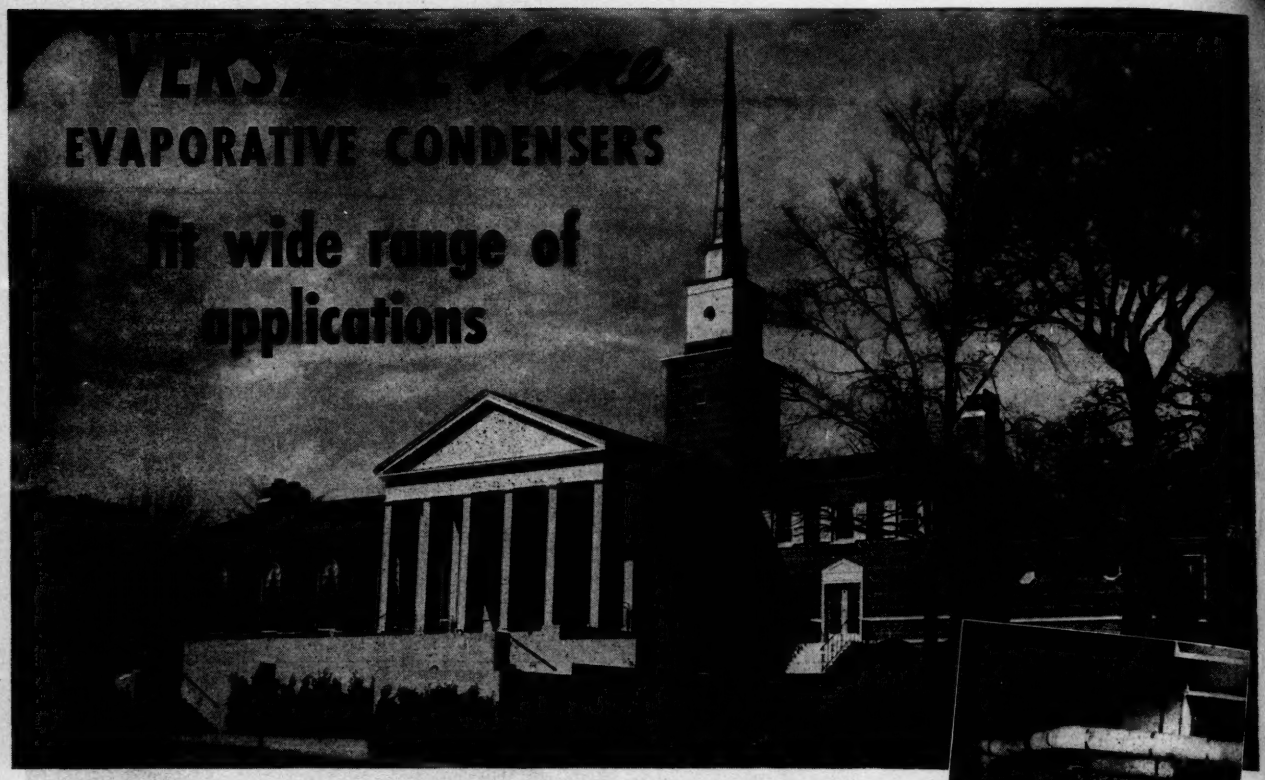
**SEE YOUR ALCO WHOLESALER**

**ALCO VALVE CO.**

859 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

5356



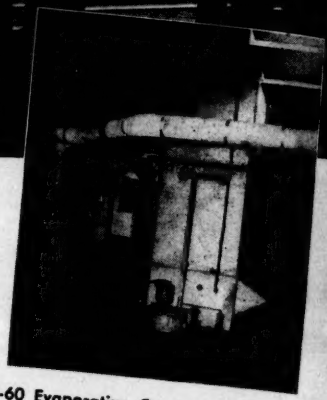

The First Church of Christ Scientist in Birmingham, Alabama.

Two recent installations of Acme Evaporative Condensers show the wide range of applications for which they are ideally suited. The ability to conserve water makes the operation very economical, while the functional design assures complete hot weather comfort.

One installation was made in the First Church of Christ Scientist in Birmingham, Alabama, by the Hardy Corporation. The main auditorium seated 650 persons and a Sunday School room accommodated 148 more. Despite the variable load and Birmingham's hot climate the FP-60 Acme Evaporative Condenser has been highly efficient and completely satisfactory.

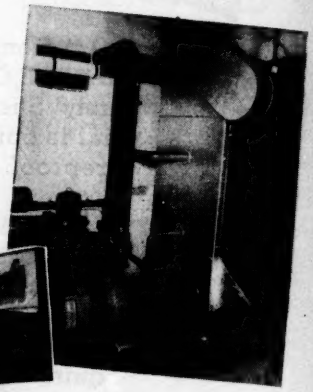
A completely different installation was made by the Krauss Heating and Ventilating Company, at the Gulf Winds Restaurant in St. Petersburg, Florida. An FP-30 evaporative condenser serving as an important component of the air conditioning system, was installed.

The air conditioning added much to the comfort of the patrons of this beautiful restaurant. Despite the unusual hardness of the water, the equipment is satisfactory in every respect, saving over 95% of the water used.

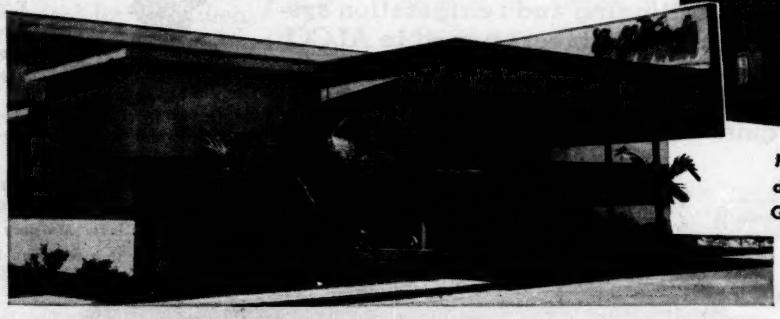


FP-60 Evaporative Condenser installation at the First Church of Christ Scientist.

*Write for more complete details on the advantages of Acme Evaporative Condensers*



FP-30 Evaporative Condenser installed at the Gulf Winds Restaurant.



The Gulf Winds, popular St. Petersburg, Florida restaurant.

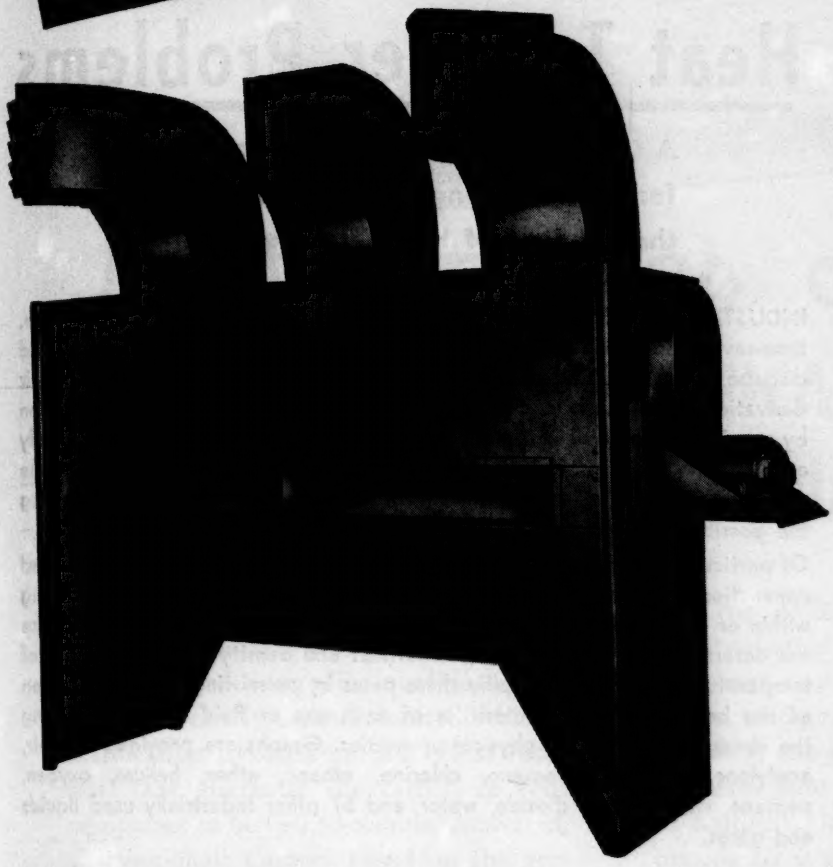
**ACME INDUSTRIES, INC.** JACKSON, MICHIGAN, U. S. A.

**Air Conditioning and Refrigeration Division**

*CONTINUOUSLY SERVING THE AIR CONDITIONING AND REFRIGERATION INDUSTRIES SINCE 1919*

*Another* STURTEVANT DEVELOPMENT!

# IMPROVED INDUSTRIAL HEATER
## for heating large plant areas



**Two *new* Industrial Heaters with wide applications:**

**GENERAL PURPOSE HEATER**
**for manufacturing areas, warehouses, garages, commercial buildings—with standard heating coils.**

**HEAVY DUTY HEATER**
**for continuous-duty high-pressure systems, or industrial process work—with wrought iron heating coils.**

### EXCLUSIVE STURTEVANT FEATURES

HEAVY DUTY HEATERS—For rugged service, wrought iron 1" pipe is used instead of copper tubing. Tapered steel fins are metallically bonded to the pipe. Solder bath provides permanent bonding and corrosion-resisting external coating. Internal steam distributing pipes are also wrought iron, protect against freezing. *The entire coil assembly is as rugged as the connecting steam lines.*

SMOOTH EXTERIORS—Die-formed casings with rounded corners eliminate accident-causing sharp edges and dirt-catching pockets. Removable panels aid inspection.

ONE WARRANTY—Only Westinghouse makes all principal components—fans, heating coils and motors. You get unit engineering and single equipment responsibility.

Other features are:

WIDE RANGE OF SIZES—Heat output up to 2,500,000 btu/hr; air volumes up to 25,000 cfm; steam pressures up to 200 psig. ACCESSORIES—Filter boxes optional for mechanical air cleaning. Mixing boxes optional for proportioning outside and re-circulated air.

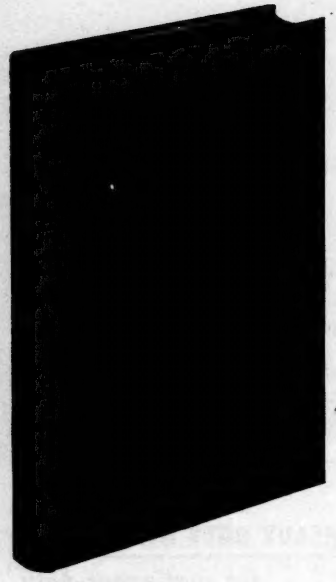
For more information, contact your nearest Westinghouse Sturtevant office. Or write for Catalog 1510, soon off the press. Address Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.

**YOU CAN BE SURE...IF IT'S Westinghouse**

**AIR HANDLING**

J-80277

# Time-Saving Working Charts Speed Solution of Heat Transfer Problems



The author, F. W. Hutchinson, is Professor of Mechanical Engineering at the University of California. His knowledge of heat transfer is well-grounded on practical experience as well as theory, as he acts as consultant on heat transfer problems for many industrial firms.

**336 Pages**

**$6.00**

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**A Combined Text and Reference Book for the Practicing Engineer as well as the Student of Heat Transfer**

INDUSTRIAL HEAT TRANSFER, by F. W. Hutchinson, provides a selective, time-saving approach to methods of heat transfer analysis. It presents and discusses equations finding the widest industrial application, analyzes their derivation, and then brings the subject to an eminently practical conclusion by providing graphs which permit direct visual solution of the most commonly encountered problems. The 123 working graphs are equal in accuracy to the equations from which they are derived, thereby saving time and reducing the possibility of error in making calculations.

Of particular interest to the industrial engineer is the section covering forced convection of gases and liquids, whether heating or cooling, while flowing within or outside of pipes. Analytical solution for these cases would require the determination of viscosity, specific heat and density—all as functions of temperature. The graphs simplify these cases by permitting direct evaluation of the heat transfer characteristics of each gas or fluid without requiring the determination of any physical properties. Graphs are provided for: air, acetylene, ammonia, benzene, chlorine, ethane, ether, helium, oxygen, pentane, steam, sulfur dioxide, water, and 57 other industrially used liquids and gases.

## Five-Day Free Inspection!

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# BRIEFLY STATED

• O. D. Metz of The Emerson Electric Mfg. Co., St. Louis, Mo., assumes the duties of manager of motor sales, succeeding William R. Fraser, who retired effective July 1. Mr. Fraser started with the company in 1909. Mr. Metz became associated with Emerson-Electric in 1923, and has served as sales representative, assistant manager of motor sales, manager Detroit district, and manager of eastern district, in New York. W. H. Thias, with Emerson-Electric since 1935, has been appointed assistant manager of motor sales. He formerly held positions of motor sales engineer and assistant manager of hermetic motor sales. Howard Sample, formerly assistant manager of merchandise sales, has been appointed manager of Emerson-Electric's eastern district with headquarters in New York City. R. G. Bardon, who has had 29 years' service with the company, and until July 1, was sales representative and chief merchandise sales correspondent, has been appointed assistant manager of merchandise sales.

• Howard B. Steggall, a vice president of United States Radiator Corporation since 1945, has been appointed senior vice president. In his new capacity, Mr. Steggall will have direct responsibility for sales, manufacturing and engineering, advertising and industrial relations for the U. S., Pacific, Cyclotherm and Metal Products Divisions. In 1922, Mr. Steggall joined the company as an engineer in Detroit. He served as a salesman in New York City, and was promoted to manager of the U. S. branch at Pittsburgh, manager of the Magnesium Division, and vice president—Pacific Steel Boiler Division.

• Ralph A. Rockwell, formerly director of engineering at the Mason-Neilan Co. of Boston, has been appointed technical consultant for the Valve Division of Minneapolis-Honeywell Regulator Co.

• Henry G. Strong was elected chairman of the Refrigeration Industry Safety Advisory Committee, by that group at its June 24 meeting. Edward L. Hart became vice chairman, and Robert L. Williams was reelected treasurer. The new chairman succeeds L. W. Larsen, sales manager, Refrigeration Division, Tecumseh Products Company. Mr. Strong is manager of transportation sales and code representative with Carrier Corp.

• Arnold B. Medbery has recently joined the products engineering department of The Trane Company, La Crosse, Wisconsin. He will handle engineering standardization duties in the design and development of air conditioning and refrigeration products. Mr. Medbery has been associated with the Elliot Company, Jeanette, Pa., as development engineer in the blower division for the past four years.

• The Air Pollution and Smoke Prevention Association of America, Inc., which has been suffering from hyperonomatomekia for more than two years, finally did something about it. It has changed its name to Air Pollution Control Association. Hyperonomatomekia is plain Greek for plain English "unusually long name," according to Robert T. Griebling, executive secretary of the association.

• Texas Gas Transmission Corp. construction crews started work in August on a new 408-mile, 26-inch natural gas pipe line. The announcement came after the Federal Power Commission authorized the $33.7 million project. The pipe line is designed to carry 240 million cubic feet more of natural gas a day to over 30 distributing utilities from Louisiana to Ohio. L. E. Ingham, vice-president in charge of operations and engineering for Texas Gas, said his Company would make every effort to complete as much of the lines as possible before winter sets in.

• Four executives of Crane Co. have taken new assignments, as a result of action at the July meeting of its board of directors. In announcing the promotions, J. L. Holloway, president, pointed out that F. F. Elliott, previously vice-president in charge of branches, moves into the newly created office of senior vice-president in charge of sales. After serving as district manager of the Pacific Coast area since 1943, Mr. Elliott came to Chicago in May, 1951, on becoming vice-president. He joined Crane Co. in 1922 and was named manager of the San Francisco branch in 1929. Mr. Elliott took his advanced training in mechanical engineering at the Rolla School of Mines. George L. Erwin, Jr. was promoted to the new position of vice-president in charge of heating sales. Prior to this promotion Mr. Erwin was manager of the jobbed products department. H. H. Bunchman, treasurer of the company since 1948 and a director since April, 1951, has been given the new title of vice-president and treasurer. A. H. Prasse, assistant manager of branches since 1943 has been appointed general manager of branches. Mr. Prasse joined Crane Co. in 1936 as a member of the branch house department.

• The appointment of Merle L. Erickson as a research fellow in the research laboratory of the American Society of Heating and Ventilating Engineers in Cleveland, Ohio, was announced at the society's New York headquarters August 5. Mr. Erickson, at present a research fellow at the Engineering Experiment Station of the University of Minnesota, will assume his new duties on September 15. His first assignment will be a study of the thermal properties of building materials, which was approved by the Society's Committee on Research at the Semi-Annual Meeting in Spring Lake, N. J., recently on the recommendation of the Technical Advisory Committee on Insulation. The recent addition of two engineers to the laboratory staff was also announced. They are Aydin Umur, a graduate of Robert College and Engineering School, Istanbul, Turkey, now a graduate student at Case Institute, Cleveland, who is assisting on panel heating studies; and Donald J. Vild, graduate from Case Institute this June, who will assist in work on shading devices and in other work under the general direction of the Technical Advisory Committee on Cooling Load.

• The Wagner Electric Corp. recently announced the appointment of A. Callaway Allen as sales manager of the Electrical Division to succeed H. A. Hudson who has a new position as sales analyst for the company. Mr. Allen began his career with the Wagner company in 1930 immediately after graduating with a Bachelor of Science Degree in General Engineering from the University of Illinois. In 1935 he was transferred to ultimately become manager of the Wagner electrical sales branch at Memphis which position he held until his recent promotion.

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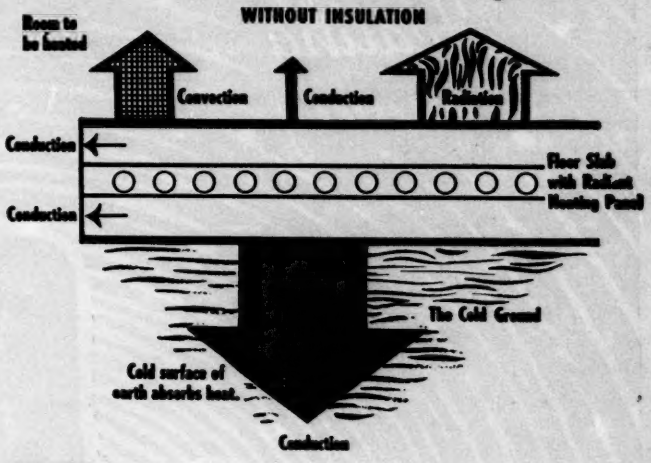
The GUIDE of the Amer. Society of Heating and Ventilating Engineers says, *"When the heating pipes are imbedded in a concrete floor slab a portion of the heat emitted by the pipes will flow upward into the space to be heated, and the remainder will flow downward into the ground.*

*"When the heating pipes are placed below the concrete floor slab instead of being imbedded in the slab, a larger portion of the heat will flow into the ground, and a smaller portion into the space to be heated."*

**Heat Flow from Floor Radiant Heating Panel**
**WITHOUT INSULATION**

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**Heat Flow from Floor Radiant Heating Panel**
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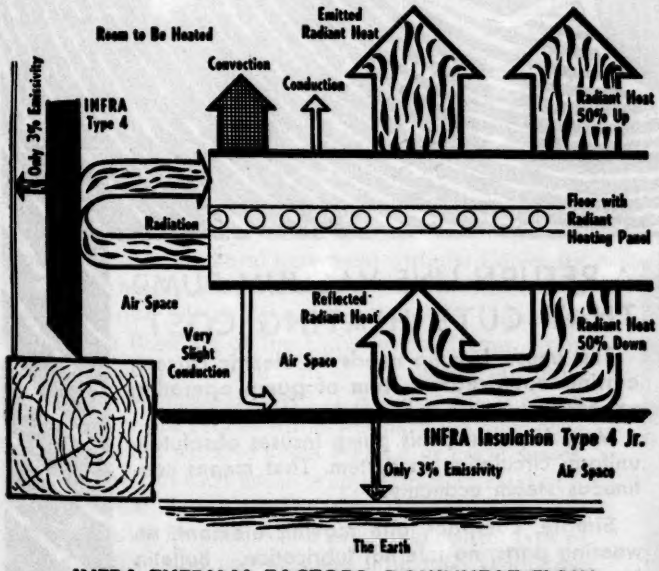


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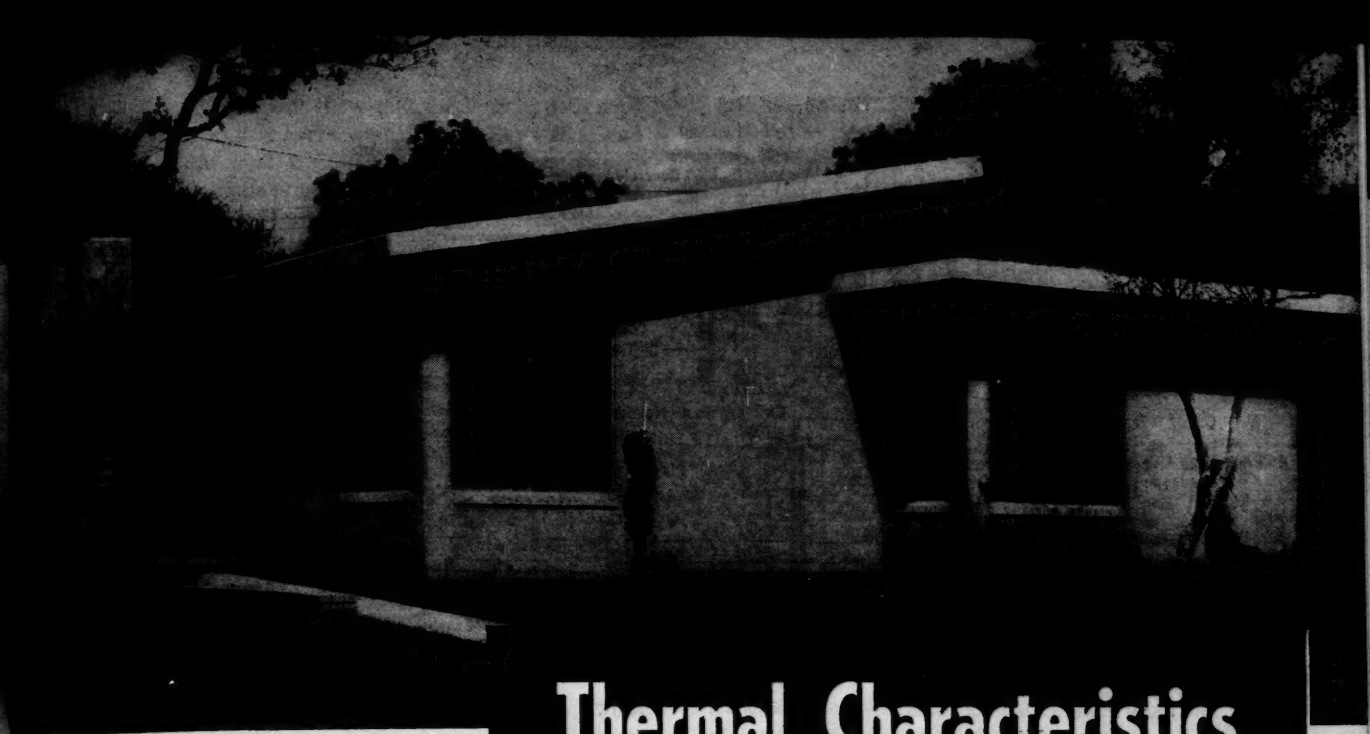

Ceramic house No. 4.

# Thermal Characteristics of Ceramic Houses

WAYNE E. LONG

Professor, Department of Mechanical Engineering, University of Texas, Austin, Texas

**Supplementing a report by Dean W. R. Woolrich in the May issue on livability in six tile and brick houses of similar orientation and floor area, heat flow through walls of these Texas houses is now discussed in some detail. A subsequent article will cover cooling the houses by roof spray.**

IN 1948, the Acme Brick Co. of Ft. Worth, Texas, through the agency of the Coates Co. of Austin, entered into a contractural agreement with the University of Texas whereby six houses would be constructed in Austin for research to be conducted by the Bureau of Engineering Research of the University of Texas. From the architectural standpoint all of the houses are quite similar in most respects. Typical is house No. 4 shown at the head of this article. All houses have the same compass orientation. All have floors over air or crawl spaces. The floor space of each house is approximately 1700 sq ft and, in general, floor plans are identical. Each house has a wood burning fireplace, some additional central type of heating system, and one or more attic type ventilating fans. All houses have the same glass window area but different types of windows for test purposes. Different floor, wall, ceiling and roof constructions are used for comparative reasons. Five of the houses are of ceramic construction while the sixth (Fig. 1), used as a standard of comparison, is frame, conforming to FHA specifications in all respects.

Typical floor, roof and wall sections for the several houses are shown in Fig. 2. The joistile construction for the floors and roofs of the ceramic houses is a type of precast ceramic tile-reinforced concrete joist developed by the Structural Clay Products Institute and the Bureau of Engineering Research of the University of Texas.

The research work on the thermal and human comfort phase of the investigation was to be restricted to those

Fig. 1. Standard frame house, No. 5.

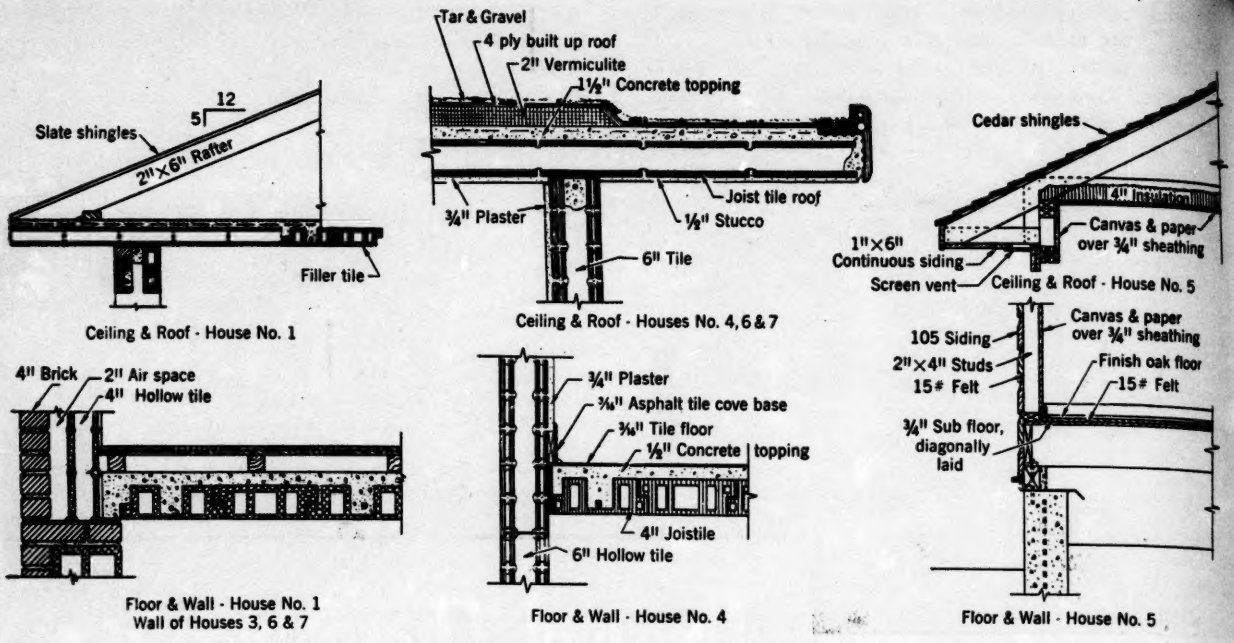


Fig. 2. Roof and wall sections of houses.

characteristics peculiar to ceramic construction as contrasted to frame construction. These characteristics include thermal conductivity, thermal capacity, moisture capacity and permeability, and related factors. Each house was to be tested individually, but simultaneously with the frame house as a control, and compared to every other house of the group.

One of the first objectives of the research was that of investigating the effect of thermal capacity of building materials on the heat transmission through a wall or other similar barrier. It is a well known fact that when heat transmission calculations for building construction are based on the equation $Q = UA\triangle T$ it is assumed that steady state conditions exist and that there is a constant temperature difference on the two sides of the barrier for a sufficient length of time to establish constant and unidirectional flow of heat. These conditions are seldom, if ever, obtained outside of the laboratory. Steady flow conditions are approached in actual construction for very thin, high density, barriers such as glass where the time lag of heat flow is practically zero. As the thickness, mass, and thermal resistance of the barrier increase, the thermal storage capacity and the time lag of the materials tend to defeat the validity of the steady flow equation until, in massive construction similar to brick and tile, the use of the equation can not be justified. Heating and cooling engineers have long realized the weakness of the use of the commonly used *U* factor but have had too little data on the many types of construction to justify its complete discard in favor of any other method. Some research has been done by the ASHVE in both laboratory and field applications, but thus far no completely satisfactory solution of the problem has been found for all types of construction. So most consultants work out their own methods based on experience and settle for "guesstimation" because of a lack of accurate and complete data.

Preliminary data for heat flow through ceramic walls as obtained in these tests indicate that for certain types of construction the heat flow through the wall is practically never steady in character, nor does it approach uni-directional flow for any great period of time under the test conditions outlined below. The results of tests on houses 3 and 4 are presented in Fig. 3 and 4, but in studying these relationships the following conditions should be kept in mind:

(1) A north wall of each house was used as the test section in order to reduce solar and sky radiation effects to a minimum.

(2) The houses have the same geographical orientation and are on adjoining lots, being approximately fifty feet apart.

(3) Data were obtained on north walls of both houses simultaneously.

(4) Both houses were unoccupied and completely closed during the entire test period with no intentional circulation of indoor air.

(5) The walls are constructed as shown in Fig. 2.

(6) The theoretical heat flow is based on the use of the *U* value calculated from data taken from the 1950 ASHVE Guide. This coefficient has a value of 0.277 Btu per (sq ft) (hr) (F) for house No. 3 and a value of 0.417 Btu per (sq ft) (hr) (F) for house No. 4.

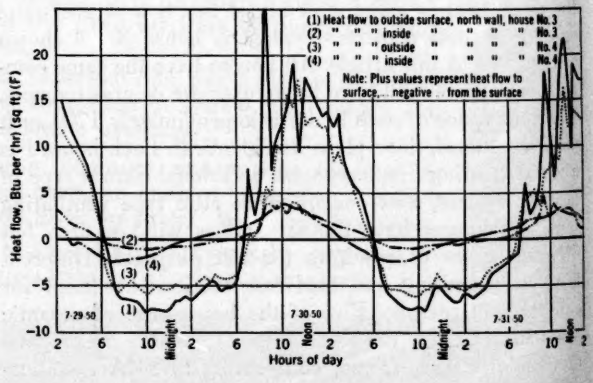


Fig. 3. Heat flow through north walls of houses 3 and 4.

A study of Fig. 3 will show that the heat flow to each surface of the wall changes quite rapidly, at times, and that the condition of steady flow is never very closely approached. Irregularities of the heat flow curve are very distinct, but much of this variation may be explained by the corresponding irregularities of the outside atmospheric conditions. Clouds, air currents, reflected sunlight from surrounding objects, and other conditions which could not be controlled, all had their influence upon the flow of heat to or from the outside surface of the wall. An inspection of the heat flow to or from the two surfaces of the same wall will reveal that the heat flow was seldom, if ever, uni-directional. If the time period from 6:00 p.m. to 6:00 a.m. on July 29-30 be taken as a study it will be noted that the heat was flowing *from* each surface for the entire time, indicating that the wall had been acting as a heat reservoir and is now releasing this stored energy to both contiguous spaces. For the period of time 6:00 a.m. to 6:00 p.m. on July 30, the reverse condition is true and heat is being stored in the mass of the wall. These conditions are nearly identical for the walls of both houses.

A study of the temperature difference curves, along with the heat flow curves, of Fig. 4 gives an idea of the time lag of heat flow through the two types of wall construction. If the time 4:00 p.m. July 30 be considered for

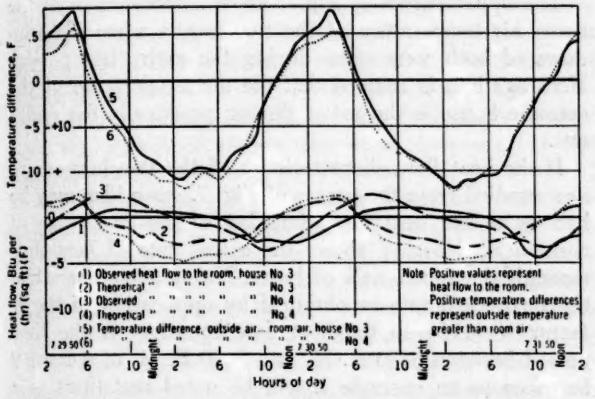
Temperature difference, F
Heat flow, Btu per (hr) (sq ft) (F)
(1) Observed heat flow to the room, house No 3
(2) Theoretical " " " " " No 3
(3) Observed " " " " " No 4
(4) Theoretical " " " " " No 4
(5) Temperature difference, outside air - room air, house No 3
" " " " " No 4
Note Positive values represent heat flow to the room. Positive temperature differences represent outside temperature greater than room air
Midnight
Noon
Hours of day

Fig. 4. Comparison of actual and theoretical heat flow through north walls of house 3 (U=0.277) and house 4 (U=0.4175).

the maximum temperature difference, it will be seen that the maximum heat flow into the room does not take place until about 8:00 p.m. of the same day. Thus, there is about a 4 hour time lag of heat flow to the room from the effect of the outside air temperature. A similar study for the time lag of heat flow back from the room to the outside air at night will reveal a time lag of about 7 hours. This lag may be seen if the time of 3:00 a.m. July 30, when the temperature difference is a maximum, is compared to 10:00 a.m. of the same day when the heat flow is a maximum. This greater time lag for the outward flow of heat can be understood if it is kept in mind that the outside wall surface is at a much higher temperature than the inside surface and that more time is required for the lowering of this temperature to a value which will permit the lower temperature heat within the room and at the inner surface of the wall to flow to the outside air.

It is also interesting to note that the heat flow curves of these walls are almost "parallel" with an occasional crossing of the actual flow curves. Since the inside-outside

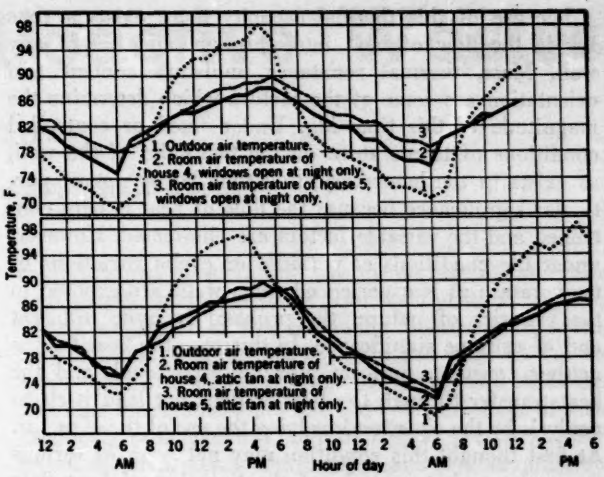
Temperature, F
1. Outdoor air temperature.
2. Room air temperature of house 4, windows open at night only.
3. Room air temperature of house 5, windows open at night only.
1. Outdoor air temperature.
2. Room air temperature of house 4, attic fan at night only.
3. Room air temperature of house 5, attic fan at night only.
AM
PM
Hour of day

Fig. 5. Temperature characteristics of houses 4 and 5, ventilation at night only.

air temperature differences are practically identical for the two rooms under consideration, this crossing of the heat flow curves can be caused only by the thermal capacity characteristics of the two walls.

It is evident from only a casual study of the thermal time lags as shown in these data that this characteristic of massive construction inherently works to the comfort advantage of the occupant during the daytime, but, by the same reasoning, creates an undesirable degree of discomfort during summer nights. However, a judicious use of either natural or mechanical ventilation, whereby the relatively cool night air is used to offset the heat stored in the mass of construction, will turn this thermal capacity characteristic into an advantage for both day and night.

In massive barriers of this type the flow of heat is unpredictable. Some of the heat which enters the surface of the barrier may continue through to the other side and emerge as a heat load on the conditioned space; or all, or any part of it, may be used in increasing the temperature of the mass of the barrier. The amount of heat used in raising the mass temperature may be expressed by the equation:

$$Q = wc\Delta T$$

where: Q = heat energy stored in the mass of the barrier, Btu

w = weight of material receiving heat energy, pounds

c = specific heat of the material of the barrier, Btu per lb (F)

$\Delta T$ = increase of the mass temperature, F.

From this equation it may be seen that all, or any portion, of the heat entering either surface of a barrier may be used in producing a temperature increase of the mass of the barrier, while, at any specified instant, none of the heat may be passing on through to the surrounding air. During the collection of data for the curves of Fig. 3 and 4 it was observed, at different times, that heat flowed *out* of the wall in *both directions; into* the wall from *both directions;* and *through* the wall from *each direction.* The direction and magnitude of this heat flow depend upon too many variables for a strict theoretical analysis or for safe prediction. It seems, therefore, that the most successful and logical approach to this problem is through experimental channels.*

*Exhaustive research as a continuation of this paper is now being done on this problem by the author and Dr. F. E. Giesecke of New Braunfels, Texas.

Because of this thermal capacity there exists a time lag in the flow of heat into, through, and out of any wall. Mass, thermal resistance, moisture content and orientation are some of the factors which determine the magnitude of this time lag. Under fixed or controlled conditions of temperature on the two sides of the wall, as exists in the laboratory, this time lag is not of particular significance because the flow of heat is here controlled and the variable factors are eliminated. However, under the conditions of periodic or cyclic variations of temperature as is experienced when walls are exposed to the vagaries of nature, the problem is quite different and of extreme significance. In this case the heat flow is neither constant, uniform, nor uni-directional, and the heat transfer through the barrier does not lend itself to analysis by the equation involving the use of the *U* factor. At first thought this condition may not seem of serious consequence, but a study of the time lag of heat flow through massive walls and a consideration of its effect upon the inside temperature and upon the maximum heating or cooling load (especially the latter), and its time of occurance, may reveal some surprising facts.

Figs. 5, 6, and 7 depict some of the thermal characteristics of houses four and five of this project. It should be noted that house four is of ceramic construction while house five is the frame constructed, control house. The data for lower curves of Fig. 5 were obtained with all windows of both houses open at night, attic fans running and pulling air through each house for the entire night, but fans off and all windows closed during the day. It will be noticed that the inside air temperature of the two houses is about the same, with that of house four being, perhaps, slightly lower. This condition would be expected so long as night air is being circulated through the houses, but the lower temperature of house four when the fans are off seems to contradict the expected results as obtained with application of the equation $Q = UA\triangle T$. The house with the greater value of *U* should, mathematically, have a higher temperature since a greater time rate of heat flow would, supposedly, be taking place. The fact that actual performance seems to contradict theoretical expectations can be explained only by the thermal capacity characteristics of the materials of construction of the two houses.

Data for upper curves of Fig. 5 were obtained with the windows of both houses open during the night and closed during the day, and without operation of the

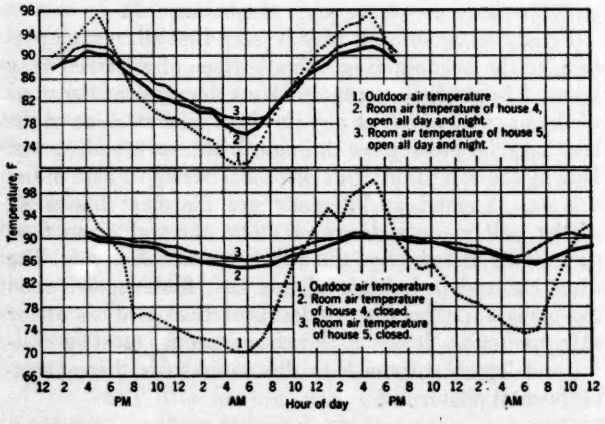
Temperature, F
1. Outdoor air temperature
2. Room air temperature of house 4, open all day and night.
3. Room air temperature of house 5, open all day and night.
1. Outdoor air temperature
2. Room air temperature of house 4, closed.
3. Room air temperature of house 5, closed.
PM
AM
Hour of day
PM
AM

Fig. 6. Temperature characteristics of houses 4 and 5, windows open vs. windows closed.

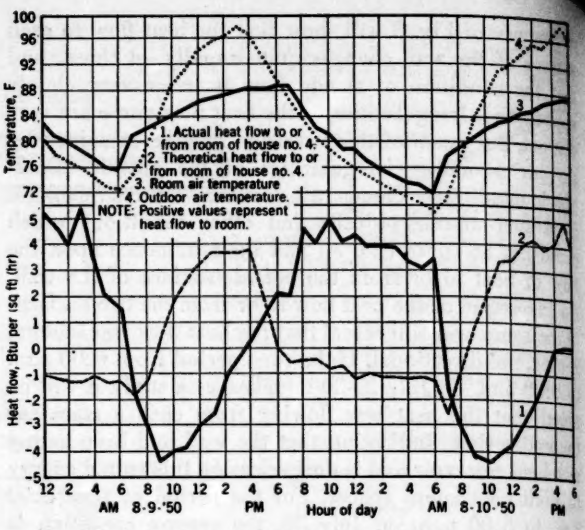
Temperature, F
Heat flow, Btu per (sq ft) (hr)
1. Actual heat flow to or from room of house no. 4.
2. Theoretical heat flow to or from room of house no. 4.
3. Room air temperature
4. Outdoor air temperature.
NOTE: Positive values represent heat flow to room.
AM 8-9-'50
PM
Hour of day
AM 8-10-'50
PM

Fig. 7. Actual vs. theoretical heat flow, house No. 4.

attic fans. The curve shapes are, as would be expected, about the same as the lower curves of Fig. 5.

Fig. 6 shows a comparison of the performance of the two houses when both were closed for the entire 44-hour test period. The ceramic house was cooler for the entire time both day and night.

The upper curves of Fig. 6 show a comparison of the room air temperature of the two houses when the windows of both were open during the entire test period. Here again it is noticed that the air temperature of the ceramic house is the lower during practically the entire test.

If the heat flow characteristics of the two houses are now studied from the curves of Fig. 7, some idea may be had as to the heat flow time lag of the two types of construction. Fig. 7 shows the actual rate of heat flow through the north wall of house No. 4 as compared to the theoretical rate as obtained by application of the *U* factor (0.4175) in the heat flow equation. If the time period between 8:30 A. M. and 3:30 P. M. of August 9 be taken as an example it will be noted that there is a time lag of approximately seven hours between the zero periods of theoretical and of actual heat flow. This heat flow time lag for house No. 5 was about three and one-half hours for the time period 8:30 a. m. to 12 noon.

These time lag factors for the flow of heat through different types of walls have definite measurable effects on the inside air temperature of a space which, in the final analysis, is the major criterion of human comfort. Some idea of the time lag of room air temperature, as compared to outdoor temperature, may be obtained from the temperature curves of Fig. 7. House No. 4 having the greater thermal capacity has the greater time lag, both in heat flow and in temperature, and yet it also has the lower maximum and lower average room air temperature; this in spite of its greater overall coefficient of heat transmission [0.4175 Btu per (sq ft) (hr) (F) as compared to 0.277 Btu per (sq ft) (hr) (F) for house No. 5].

It is hoped that further research, and the analysis of test data already obtained, will lead to a logical and more practical method of analysis of the heat flow through massive barriers. This research is continuing and the results will be made available to the profession as they are analyzed and made ready for publication.

# Treatment of Radioactive Wastes

W. K. EISTER

Chemical Technology Division, Oak Ridge National Laboratory

**From the large problems of waste disposal facing atomic energy installations, engineers will gain a useful background for handling design of waste disposal systems for industries which may use radioisotopes in their processes. The following is based on information released at the third annual Oak Ridge Summer Symposium which was on the role of engineering in nuclear energy development.**

THE proper treatment and disposal of radioactive wastes represents a problem of major concern to the Atomic Energy Commission program. These radioactive wastes result from raw material processing, isotopic separations, nuclear reactor operation, reactor product processing, and development and research using radioisotopes. While the AEC controlled sites are the major producers of this radioactive waste, there is a steady increase (among outside organizations) in the use of radioisotopes in medical, industrial and university development and research. The problem of radioactive waste treatment and disposal will consider (1) the objective of waste control, (2) the characteristics of the radioactive wastes, (3) the control of radioactive waste disposal, (4) the general procedures for their disposal, (5) the types of radioactive wastes, (6) the processes used for waste concentration, and (7) the methods of final disposal.

The major objective of the AEC for the proper treatment and disposal of radioactive waste is personnel safety. The radiations emitted by radioactive chemical elements affect biological processes and also some chemical processes. These are usually adverse effects, and, as a result, create a significant hazard when the radiation intensity in the environment is increased. Therefore, the major incentive for radioactive waste treatment is to prevent its discharge to the environment when it would significantly increase the environmental radiation intensity.

The radiations emitted by radioactive wastes are alpha particles, beta particles, and gamma rays. Neutron emission is primarily limited to nuclear reactors and neutrons are not emitted by radioactive wastes. The mass concentration of radioisotopes which will create a condition of radioactive contamination is very small. The maximum tollerable concentration is on the order of parts per million. Therefore, it is apparent that the greater portion of the waste medium transporting radioisotopes is not itself radioactive. The prime objective in the safe operation of nuclear reactors and their associated chemical processes is to limit the amount of material that may become contaminated.

## Control of Radioactive Waste Disposal

The control of radioactive waste disposal involves the consideration of three factors: (1) the maximum permissible concentration of radioactivity, (2) the degree of environmental dilution, and (3) the storage of the radioactive waste with or without prior treatment.

The definition of the maximum permissible concentration (mpc) for radioactivity in the AEC is the responsibility of the AEC Division of Biology and Medicine. The mpc for radioisotopes varies due to variations of their chemical, radiochemical and biological properties. For mixed fission products emitting beta and gamma radiation, the mpc is $10^{-13}$ curies per cubic centimeter (c/cc) in water and $10^{-15}$ c/cc in air. For alpha emitters, the mpc is $10^{-13}$ c/cc in water and $5 \times 10^{-18}$ c/cc in air. For specific activities, the mpc may be significantly increased or in a few cases reduced.

When waste is discharged to the environment, it becomes diluted and the amount of dilution that takes place prior to the entry of the radioactive wastes into other environmental processes is taken advantage of in establishing the concentration of radioactivity in the waste discharged. The definition of this environmental dilution factor is the responsibility of the AEC Division of Engineering.

Finally, the individual AEC contractors are responsible for the disposal of radioactive wastes created by their operations. These wastes may be segregated at their source into those that must be stored and those that may be discharged without treatment to the environment. Then many of the high level activity wastes which require storage may be processed to reduce their volume. This decreases the cost and increases the safety of storage facilities. The decontaminated fraction of the waste may then be discharged to the environment or returned to the initial process.

## General Waste Disposal Procedures

There are three general approaches to the disposal of radioactive wastes. First, they may be dispersed in the environment, if, by so doing, it does not significantly increase the total activity contained in the environment. The second approach is to store the wastes either with or without processing to reduce the waste volume. Sufficient amounts of radioactivity are being produced today so that storage is the major method of radioactive waste disposal. The third approach is to use the radioactive isotopes in the waste. Utilization of significant amounts of the radioactive fission products would aid significantly in increasing the economy of the waste disposal program. Several programs for the development of uses for gross quantities of radioisotopes are now in progress. For ease in discussion, the general radioactive wastes are considered in three classifications depending on their physical state, that is, whether they are liquids, gases or solids.

## Liquid Waste

The radioactive liquid wastes at most atomic energy sites are separated into three general classifications: (1)

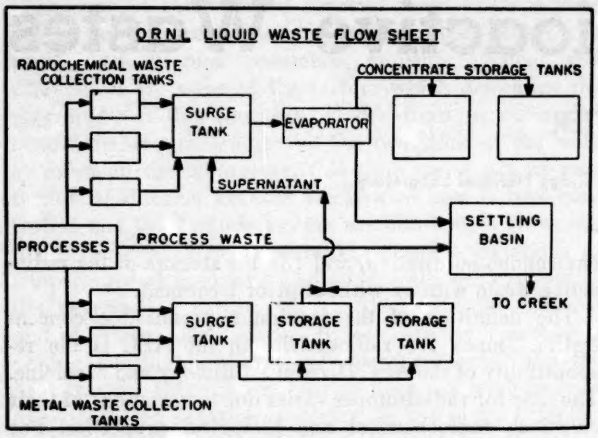


Fig. 1. Flow sheet for radioactive waste collection system at Oak Ridge National Laboratory.

metal wastes which contain high concentrations of source and fissionable materials such as uranium, thorium, and plutonium, along with radioisotopes, primarily fission products, (2) radiochemical wastes which contain high concentrations of radioisotopes, again primarily fission products, with a relatively low concentration of source and fissionable materials, and (3) process wastes which are composed of water from sources which have some probability of becoming contaminated, such as condensate from radiochemical reactor jackets, condenser water and radiochemical cell floor drainage.

The collection system for radioactive liquid wastes used at Oak Ridge National Laboratory is somewhat typical of all AEC sites (see Fig. 1). In the ORNL system, the metal wastes, radiochemical wastes, and process wastes are collected in separate drain systems, with the metal wastes and radiochemical wastes sent to underground storage tanks, while the process waste which contains very little radioactivity is sent directly to a settling basin. The source and fissionable materials are precipitated from the metal wastes in the underground storage tank and the supernate is then decanted to the radiochemical waste system. The solution collected in the radiochemical waste system is sent to an evaporator where its volume is reduced, with the radioisotopes remaining in the concentrated pot liquor. The water vapor is condensed, checked for radioactivity and then discharged to the settling basin. The radioactivity that reaches the settling basin is held up for a short period of time after which it is discharged into White Oak Lake. The effective retention time in White Oak Lake is five to ten days or more, depending upon the flow in the creek, after which it flows into the Clinch River.

The objective of processing liquid waste is to reduce its volume before storage. These liquid wastes are usually composed of 1 to 10% solids with the mass of radioactive isotopes equal to one part per million or less. The ultimate goal, therefore, of the waste process would be to separate completely the radioisotopes from the non-radioactive isotopes before storage. At the present time, this ultimate goal is not being reached. Two general types of processes are in operation. The objective of the first is to separate the bulk non-radioactive components from the solution and the second is to separate the radioactive isotopes from the solution.

Evaporation has been the most successfully applied separation method for bulk non-radioactive components. By this procedure, water and volatile acids can be removed from the radioactive solution. This water and acid can then be reused in the process or discharged to the environment. The effectiveness of the evaporation procedure is limited by two factors, first, volatile radioactive isotopes and entrainment. Iodine and ruthenium are the principal volatile radioactive isotopes contained in the waste and little difficulty has been experienced with these species when evaporated under alkaline conditions. The entrainment problem has been the most serious. Here it was found that a decontamination factor of about $10^3$ to $10^4$ was the maximum that could be obtained by simple evaporation (the decontamination factor is defined as the concentration of a specific material in the feed divided by the concentration of the same material in the product). However, by installing a de-entrainment device in the vapor line, it has been possible to increase the decontamination factor to $10^5$ to $10^6$. The most effective of the de-entrainment devices has been found to be a glass wool filter.

A good radioactive waste evaporator now in operation is located at Knolls Atomic Power Laboratory. This is a forced circulation type system consisting of a flash pan, circulating pump, heat exchanger, de-entrainment tower and condenser. This evaporator is operated under 6 inches of mercury pressure absolute in the flash pan and the entrainment tower. However, the heat exchanger operates at slightly higher than atmospheric pressure. This effectively prevents evaporation and consequent scaling on the heat transfer surfaces. About 1% of the recirculating stream evaporates upon entering the flash pan. This vaporization produces a spray which knocks down foaming (see Fig. 2). The feed for this evaporator is relatively low in activity and contains about 1% solids. The feed is added to the evaporator until the total solvent content of the evaporator heel is approximately 30 to 40%. Then the feed is shut off and the evaporation continued until a test sample shows that cooling the evaporator concentrate will cause it to solidify. This charge is then dropped into drums, cooled and allowed to solidify in the drums and then stored.

A second procedure for the separation of bulk non-radioactive components from the radioactive waste solution that has been demonstrated is crystallization. Many of the waste solutions contain large amounts of sodium nitrate. By acidifying the concentrated liquor from an

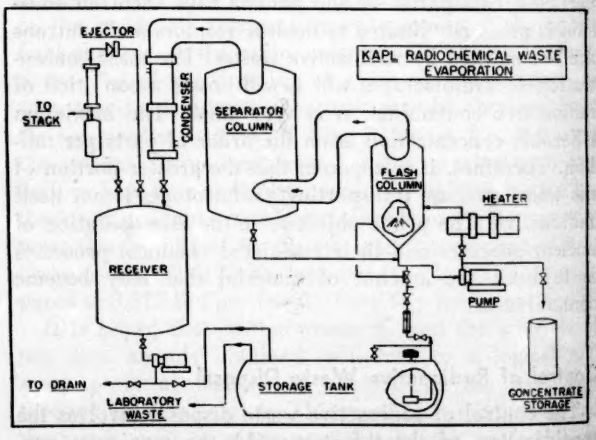


Fig. 2. System for evaporating radioactive waste at Knolls Atomic Power Laboratory.

evaporation and reducing the temperature, it is possible to crystallize out the sodium nitrate, and, with about three crystallizations cycles, a decontamination factor on the order of $10^5$ has been demonstrated. The utilization of this procedure, however, is not attractive because of relatively high process cost and lack of demand for the slightly contaminated sodium nitrate.

The ion exchange procedure has been used for both the bulk non-radioactive component removal and the removal of radioactive species. While ion exchange is not being used to any significant extent at the present time, its use for the final decontamination of evaporator condensate and other aqueous streams containing low salt concentration has been indicated.

### Precipitation

The separation of radioactive species from the bulk non-radioactive components of radioactive liquid wastes has been carried out by co-precipitation and biological assimilation. The co-precipitation procedures are similar to those used in water treatment where iron and aluminum hydroxide floes are used to remove the radioactivity from the water. This technique has been particularly successful where only a few specific radioactive species are present in the waste. Work is now in progress applying this procedure to mixed fission product waste. The significant advantage of this type of procedure is, that the non-radioactive material associated with the radioactivity in the final product is only that included in the precipitate. Therefore, significantly greater volume reduction factors can be obtained by this method than by evaporation, especially with solutions containing high salt concentrations. In addition, it is a low cost operation.

The biological assimilation procedure for the removal of plutonium from liquid wastes has been successfully demonstrated at Los Alamos. This involves established sewage disposal techniques using bacteria known as Zooglea Ramigera. By the use of either trickling filter or an activated sludge technique, these bacteria were capable of removing a significant part of the plutonium from waste solution.

The products of the waste processes are finally disposed of by sending the decontaminated components such as water and acid back to the process or out into the environment with the concentrated fission products being sent to underground storage tanks. At some sites, the liquid waste has been converted into a solid by mixing in concrete and this concrete is either buried directly in the ground, stored above ground, or dropped to the ocean bottom.

At Hanford, large volumes of relatively low activity wastes are created. The activity of these wastes is too high to be discharged into the river; however, it was found that the soil in that region had high chemical exchange properties. Therefore, this waste is disposed of by pumping into dry wells.

### Gaseous Wastes

The radioactive gaseous wastes are in most cases air contaminated with one of three types of radioactivity; (1) radioactive rare gases such as xenon, argon, and krypton; (2) chemically reactive gases such as iodine; and (3) radioactive solid particles.

When air is used as a cooler for nuclear reactors, a neutron radiation of the argon in the air produces radioactive argon. This air is then discharged from a high stack so as to thoroughly disperse in the atmosphere. The half-life of this argon activity is about two hours and, therefore, it rapidly disappears from the atmosphere, and if inhaled, creates little hazard because of its chemically inert characteristics.

The other radioactive rare gases, xenon and krypton, are produced as fission products of uranium and are released to the atmosphere during metal dissolution. Their separation from air can be accomplished by low temperature adsorption on something such as activated charcoal or silica gel. However, the concentrations of these gases is generally not high enough to create any hazard, and therefore, they are dispersed to the atmosphere through tall stacks in the manner similar to argon.

Iodine is also produced during fission. The removal of this gas from the air is a more important problem because of its chemical reactivity and biological assimilation. The presence of iodine in plant life gives an early indication of iodine in the atmosphere. A simple caustic scrub is effective in removing iodine from air and the resulting caustic solution is sent to the liquid radiochemical waste.

During the cooling of nuclear reactors with air and the ventilation of radiochemical processing facilities, normal operation caused a significant amount of radioactivity to be entrained in the air in particulate form. The radioisotopes represented in these particles may include all of the fission products. However, the removal of these particles from the air stream is effectively carried out by dry filtration. In some cases where the particulate load is extremely high, it is advisable to use a precleaning step involving the use of a cyclone separator, electrostatic precipitator, or a wet scrubber. However, dry filtration is often used as the step for decontamination operations.

The liquid wastes resulting from such air cleaning systems is sent to the radiochemical waste system, the solid waste that is created due to spent filters and cyclone dust will be discussed in the next section. The gaseous radioactivity may be removed and stored in gas bottles. Their volume is relatively small so that storage in standard gas cylinders is economical.

### Solid Wastes

Radioactively contaminated solid wastes include such things as contaminated process equipment, concrete, wood, laboratory glassware, as well as solid wastes resulting from the treatment of liquid and gaseous wastes. These wastes can be classified on the basis of their solubility in water and their combustibility. With water-soluble solid wastes, the techniques of including these materials in concrete has been developed to render them insoluble. The resulting concrete blocks can then be disposed of permanently by burial either on land or in the ocean.

Incinerators have now been built at many of the AEC sites for the volume reduction of combustible radioactive contaminated solid wastes. The operation of the incinerators creates a large volume of gas containing radioactivity that must be cleaned, and the operation of such incinerators is relatively expensive. Further operating experience will be required to demonstrate the value of these incinerators. However, preliminary studies have indicated that, by comparison with compression baling of the combustible wastes, the total volume of solid wastes that requires burial is not significantly reduced by incineration.

# Data on Snow Melting Systems

T. W. REYNOLDS

**Here is a practical, concise presentation of design information concerning the layout and operation of snow melting systems.**

SNOW-cleared ground over buried steam pipes first directed the attention of a number of engineers to the possibilities of designing snow melting system with limited application. It was as early as 1916 that the writer published an account of the extent of snow melting and the great heat loss from an underground steam main. The advent of radiant heating seemed to bring the thinking closer to practical realization.

In any event, the first known installation of a snow melting and disposal system appears to have been in Rochester, N. Y., about 27 years ago. Like all such systems of those days, the melting was limited to sidewalk installations. Since then great strides have been taken both in perfecting the system and in extending its diversity of use.

One does not have to be old to recall the day of the snow shovel. Although labor costs are ever higher, the snow shovel is still active and has yet to appear in a museum. We have not fully discarded the use of rock salt for de-icing walks, roadways and chutes, or the use of cinders that eventually have to be washed away. The manually operated chipper and scraper are yet heard as they leave behind unsightly wet conditions, damaged surfaces, spot films of ice, and potential liability to accident suits, disregarding personal physical inconvenience and hazard. Much of these once-tolerated conditions are vanishing with the ever increasing number of snow melting applications.

## Wide Applications Possible

The most impressive thing about snow melting systems, to the writer, is the diversified use which applications have taken. From the sidewalk to residential highways by trackways or total clearance, to highways, to parking areas at stores and elsewhere and to airport runways seems but a logical extension of its progress. But who could foresee the extension of snow melting to marquees, the removal of snow loads on structures, elimination of freezing at track switches and highway catch basins, spot clearance and clearance to the requirements of any desired pattern. One contractor welcomes the snow so that his system will spell out "Radiant Heat" in front of his place of business.

A list of snow melting systems as now applied to varying applications includes hotels, restaurants, theaters, clubs, banks, funeral homes, industrial plants, gas service stations, railroad stations, platforms and switches, bus terminals, drive-ins, playgrounds, outdoor ramps to public garages, loading areas for trucks, bottom of highway grades especially where piers are located, and walkways and doorways in any hazardous place. Airports have extended the use to taxi strips, passenger loading areas, public parking areas and the elimination of ice in door trucks of hangars. Many stores make their window displays viewable, in comfort, while keeping their lobbies inside free of trackage from snow and rain. Cold storage plants and freezing tunnels do not use snow melting systems as such, but do use them to prevent freezing of ground below the floor and the consequent buckling of floor and insulation.

More thought has been given to snow melting systems than the average reader can find time to digest in detail. Therefore, as a service, a summary of main requirements has been compiled for convenient use.

A first requirement is the determination of the snow melting load. Fortunately we have Weather Bureau records and these show that snowfalls in about 90% of the cases occur with outdoor temperature ranging from 10F to 35F and that the mean temperature within this range is 26F. Snow at this temperature has an average density of 6 lb per cu ft and the usual design fixes a melting rate of one inch per hour as being adequate. Such a melting rate is based on the thought that an abnormal snowfall or blizzard, which might occur once or twice in some seasons, would tie up a business area and thus render any belated clearing by snow melting systems of but little consequence in a relative sense.

With the latent heat of snow at 144 Btu, the melting load per inch thickness of snow will be $1/12 \times 6$ lb $\times$ 144 Btu = 72 Btu per (hr) (sq ft) of melting area. With air temperatures of 10F, 20F and 32F the respective average densities of the snow in pounds will be 3.5, 4.9 and 7.3 with corresponding melting loads of 42, 59 and 88 Btu per (hr) (sq ft) of melting area. But this is only part of the story, since the slab loses considerable heat from its edges and some more to the ground below the slab as well as to the air above the slab. The heat loss to the air is greatest with light snowfall and temperatures well below freezing and lowest when sleet packs the snow, or when the melting medium is at a low temperature. The heat loss to the ground depends somewhat upon soil conditions.

It is obvious from the foregoing that heat losses can be reduced by installing pipes a reasonable distance from the edges of narrow areas and further that as the severity of climate increases, more consideration should be given to insulating of the slab, the carrying of lower medium temperatures and delay of starting the system before snowfall begins. In any event, experience to date when considering all factors of heat loss has more or less determined the slab efficiency as 70% when insulated and 50% when not insulated. Using an efficiency of 70%, the heat for melting and for the losses itemized will be 72/70% = 100 Btu per (hr) (sq ft) of melting area at the mean temperature of 26F.

## Pick-Up Load

In addition to this load, the boiler and/or heat exchanger must have additional capacities to take care of the pick-up load and heat losses from any distributing

pipes not in the melting area. The pick-up load will add from 25% to 100% to the melting load, the higher figure being used if rapid melting is desired. It may be said, however, that this load has not as yet been rationally calculated. It is known that many systems run at too great a time lag before snow melting starts, thus indicating under-estimates on the part of designers. The warming up of one square foot of slab requires 15 Btu per inch of thickness per degree of temperature difference between the temperature 32F at which the snow would begin to melt and the initial temperature of the slab. For example, one square foot of slab 6 inches thick with initial temperatures of 0 F and 26F requires 480 Btu and 90 Btu, respectively.

The pick-up load can be eliminated by starting up the system with a low temperature when snow is anticipated and only raising the temperature as the snow falls. This, incidentally, decreases the pipe expansion with its consequent liability to fracture of concrete. A medium temperature of 60 to 80 F, which is suggested for the period before snow falls, would temporarily reduce the melting load to 50 Btu per (hr) (sq ft) of melting area.

The pick-up load, or any load, is of no particular moment economically in some installations. Thus, in the state of Oregon, snow is melted on a dangerous spot of a highway by heat obtained from a nearby natural hot water spring. Many an industrial plant uses waste steam which generally is confined to a heat exchanger wherein its condensation transfers heat to the circulated medium. Any direct application of steam to the snow melting system presents liabilities in the way of extreme pipe expansion and of condensate freezing when starting up cold. Expansion is much greater than in a space heating system, and a poorly drained snow melting system may freeze up during the standing by period. When a heat exchanger is used any process steam can be utilized, even if contaminated, since the corrosion and deposits will be limited to a small area of the system and this accessible. It is one possible application.

The excess capacity of a house heating boiler in the less severe climates can be diverted to snow melting, since snow does not usually fall at the maximum low outdoor design temperature upon which the capacity of the boiler and heating system was originally determined. At an outdoor design temperature of zero, the boiler will have one-third excess capacity. In some cases a separate boiler is provided for the snow melting system to provide the balance of two-thirds; in other cases the excess capacity of the house heating boiler is used to temper the snow melting medium shortly in advance of an anticipated snowfall.

Rapid circulation of extremely cold water through a boiler, as when starting up, may cause condensation of flue gases where the boiler is used solely for snow melting. However, this may be prevented by by-passing some of the water around the boiler and controls during the warming up period. Snow melting requirements and conditions and the use of anti-freeze solutions, suggest the use of a separate boiler, heat exchanger and circulator as the most rational procedure.

### Spacing of Pipes

Spacing of pipes in the melting area will vary according to the results desired, the particular physical conditions, and the economics involved. Piping in a concrete slab should have centers for 1-inch pipe of 12 or 15 inches and for 1¼ inch pipe, 16 or 18 inches. As a rule, the greater distance is chosen from the standpoint of economics except in localities experiencing severe weather conditions where more even melting is necessary. The 12-inch center arrangement is used in asphalt or other bituminous surfaces with 1-inch pipe and in concrete slab at highway toll booths with 1¼-inch pipe because of the heavy snow load tracked in.

Where only the tracks of a driveway are to be cleared of snow, the centers are 12 or 14 inches for more rapid clearing of the tracks. The thinner paving of residential driveways delivers heat more rapidly to the surface for the same pipe area and the driveways generally are provided with 1-inch pipe on 12-inch centers. Relatively small areas with higher melting rates are likewise arranged because the cost of a larger heater with small loads is proportionately less than is the case with large areas. When a slab is reinforced it helps to distribute the heat, particularly so if the reinforcement is above the piping. Incidentally, it is thought that the piping itself may add a bit of reinforcement to a slab. Whatever size of pipe is used, it should be strong enough to withstand rough handling from fabrication, transportation and installation. Otherwise, losses may result.

The nearer the pipes are to the surface of a slab the greater the efficiency and the faster the melting rate, but piping must not be close enough to the surface to be damaged by truck loads. Fracture of concrete is also possible, but this can be avoided by installing the pipes in the fill below the slab. Expansion of piping in snow melting systems is both great and fast as these often have large temperature differentials even when not intermittently operated. However, as long as medium temperatures are not above normal requirements, the surface temperature of the slab will be no higher than for a usual summer day. Slabs are usually 5 inches thick for light loadings such as in residential driveways, 4 inches for sidewalks, and 6 to 8 inches or more in loading zones and highways. The thinner the slab, the less the pick-up load will be. Heavy loadings require the pipes to have a cover of at least 2 or 3 inches.

### Pumping Heads

Pumping heads can be reduced by using grids and a high temperature drop. Grids provide economy when used for large areas, also low friction because of header design and the use of fewer bends. They can be easily pitched for good drainage and venting. In large areas they require less balancing valves. Sinuous coils are easily shaped with full random lengths of pipe, few cuts and welds, and can be suited to irregular areas. In determining friction allowance 50% is usually added for friction of boiler, bends and fittings.

The average water temperature is 160F. Temperature drops are usually 20F but may vary from 10F to 30F to suit the size of melting area and a reasonable pumping head. A high temperature drop may cause uneven melting. The gallons per minute of water to be circulated is equal to

$$\frac{\text{Total heating load in Btu per hr}}{500 \times \text{temperature drop}}$$

### Costs

A. M. Beyers Co. in their booklet on snow melting systems, report the following costs for installation and operation. These costs have quite a range. For installation costs during 1947 to 1949, for the average driveway sidewalk and loading zone the cost given is $1 to $1.80 per square foot of melting area, and $0.75 per square foot of melting area for large roadways and parking areas. In one large area without complications the cost was even reduced to $0.40, for airport runways the cost was further cut to the range from $0.30 to $0.60. On the other hand, the cost can be over $3 if the piping is complicated and the area irregular. All of these costs are based on 1-inch of snowfall per hour.

A seasonal operating cost for an installation of 8,400 sq ft is given as $216. This system runs continuously during the winter to maintain the area above 32F, hence the cost per 1,000 sq ft of melting area per inch of snow melted is very high—$0.32. Least expensive operation reported in other cases was $0.05 to $0.07. The season covered for the 8,400 sq ft installation included 26 storms with a total of 80 inches of snowfall, thus giving a seasonal cost of $25.72 per 1,000 sq ft.

The Midtown Bus Terminal in New York City completed in 1950 does not use a solution in its snow melting system, but circulates instead what is known as "S/V heat transfer oil, light". This is a non-corrosive product of the Socony Vacuum Oil Co., Inc., which is classified as non-flammable by fire protection and insurance agencies and may be used at temperatures as high as 475F without a pressure build-up. This oil is said to be chemically stable over years of service, thus providing efficient operation due to no sludge or coating on the pipes to clog the system; nor is scale formed inside the pipe to reduce heat transfer.

### Controls

Controls in the usual system need not be elaborate since the system is usually run only when snow melting is required and then only at the peak. Operation can be entirely manual if desired. Generally, the controls are started on anticipatory basis, being started automatically when the ground or outdoor air temperature drops to 35F, or else in accordance with weather reports so as to preheat the slab. Photo electric devices are being experimented with to detect snowfall. Some snow weighing devices are also being developed. Controlling bulbs are sometimes located in the paving of the melting area and there are systems that operate at time intervals. The temperature of any anti-freeze solution is generally controlled by means of a modulating temperature controller (with bulb located in the heat exchanger) controlling a three-way valve on the steam line to the heat exchanger when steam is used.

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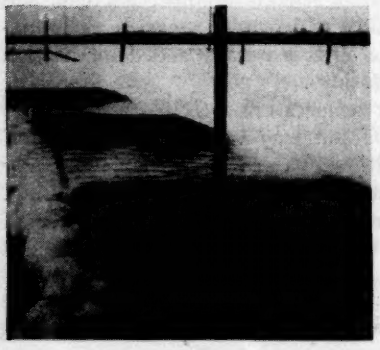
## Coal Dust Absorbs Solar Heat

Interesting experiments on the use of coal dust as a means for removing snow as a step to speed plant growth were conducted by Dr. Basil M. Bensin, formerly agronomist, Alaska Agricultural Experiment Station, University of Alaska College, Alaska.

Coal dust could be obtained easily from the Healy River valley. About two pounds of dust could be used per square yard of surface. For more even distribution the area could be marked into squares and a definite amount of dust distributed per square. For large areas, airplanes or helicopters could be used for removing snow from plowed fields and pasture land, and the amount of dust required is about 1,000 lb per acre.

Snow removal by this method was tried as a means of freeing fall-plowed land from snow so that it could be worked at an earlier date and full use made of the limited growing season. It was found that where coal dust was hand applied to 3 ft squares, these squares became free from snow in 10 to 14 days depending upon the number of sunshine hours. The temperature around coal dust on clear days climbed up during afternoon hours.



Experimental beds covered with coal dust at rate of 2 lb dust per square yard of surface.

Fairbanks normally has 309 sunshine hours during 11 clear and 7 cloudy days in April, or 68% of possible sunshine. Also during April, there are 18 possible sunshine hours daily.

Also of interest is the use of coal dust on Alaskan gardens to absorb solar heat and thus warm the soil. It was found that dry coal dust absorbs, retains and radiates sun heat ten times more than average soil. By spreading this dust on the surface of the soil, it was possible to increase soil temperature 2 to 4F to a depth of six inches during summer days. Part of this absorbed solar heat is transmitted to the air creating convection currents of heated air around the plants to promote growth of the overground parts of plants.

A series of experiments arranged by Dr. Bensin at the College Experiment Station for increasing soil temperature by an application of coal dust and also mulch paper, indicated that coal dust is more efficient than the paper.

The ground is normally so cold that it is impossible to grow good root crops. Cabbage plants, which in normal areas have root systems which may reach a depth of three feet, develop shallow roots. The use of coal dust results in a better root system.

# *Factors affecting the*

# EFFICIENT BURNING OF OIL

R. W. OLSEN and C. M. TOELAER
General Electric Co., Bloomfield, N. J.

# Factors Affecting the

# Efficient Burning of Oil

R. W. OLSEN[1] AND C. M. TOELAER[2]
General Electric Co., Bloomfield, N. J.

**While there have been many highly technical articles on combustion written for the design engineer, the authors of this article have avoided the mathematical and academic approach. They discuss the basic principles of the combustion of oil, the various components of the furnace or boiler, and the role these parts play in the combustion process. All help to provide a concept of what may be considered good design and adjustment.**

FUEL oil is a mixture of many kinds of hydrocarbons with basic properties that depend upon the origin of the oil, upon the refining processes to which it has been subjected, and its age and conditions of storage since it was refined.

The process of burning fuel oil involves five basic subdivisions. These are:

(1) Delivering the oil.
(2) Preparing oil (and air) for combusion.
(3) Breaking down the oil (atomizing or vaporizing).
(4) Mixing atomized or vaporized oil with air.
(5) Igniting and burning the mixture.

For oil to burn, it must be mixed with air in the proper proportions for oil itself does not burn. Oil vapor when mixed with the proper quantity of air does burn as illustrated in Fig. 1 and as discussed later in this article. The ratio of oil to air determines the combustion efficiency and the cleanliness of the process. Fig. 2 shows the quantity of air required for complete combustion of one pound of oil at 12.5% $CO_2$, and the resulting products of combustion.

Each oil hydrocarbon molecule contains carbon and approximately twice as much hydrogen. The carbon (C) mixes with the oxygen ($O_2$) in the air and forms carbon dioxide ($CO_2$). The hydrogen when it burns mixes with the oxygen to form water ($H_2O$). Part of the carbon may remain free and react with water vapor to form free hydrogen ($H_2$) and carbon monoxide (CO). Additional heat promotes the combustion of carbon monoxide, causing it to combine with the free oxygen in the air, forming additional carbon dioxide ($CO_2$). A smoky flame indicates that all the carbon is not being burned, and even with a high $CO_2$, means lowered efficiency.

The three major components of the heating plant are the burner, the combustion chamber, and the boiler or the furnace. Each of these are discussed separately, and their effect considered on overall running and seasonal efficiency.

The burner, by its pumping action, delivers oil from the oil tank to the unit. Pressure developed on the outlet side of the pump and burner breaks down the oil particles and establishes a spray pattern. The burner, which provides air for combustion and insures a uniform steady flow of oil and air, also includes accessories for ignition.

The combustion chamber contains the flame and thus helps vaporize the oil by re-radiation and insures that oxygen remains near the flame. It controls the flame and steadies the combustion.

The boiler or furnace has a surface arranged to absorb the maximum amount of heat. The boiler or furnace requires both primary and secondary surfaces so that as much of the heat from the burning process as possible is transferrred to the air or water as the case may be. In the case of a warm air furnace, the per cent of the furnace that is air-backed—in the case of a boiler the amount of boiler that is water-backed—has a major effect on the heat transfer and the boiler efficiency.

Many people have the erroneous impression that it is desirable to keep the flue gases within the heating unit for as long a time as is possible. When there is a given amount of air and a given amount of oil entering a combustion section, that amount must leave at the same rate at which it enters.

## GOOD COMBUSTION DEPENDS ON:

(a) Proper breaking up of oil.

(b) Adequate supply of oxygen available at the proper time, without over-excess.

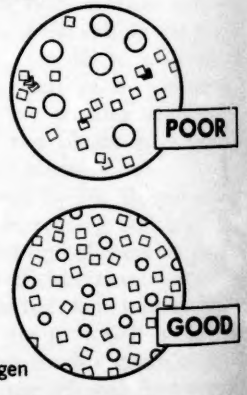



Fig. 1. Proper oil and oxygen mixture for good combustion.

[1]Supervisor, Heating Product Service, Air Conditioning Division.
[2]Application Engineer, Home Heating and Cooling Department.

The important factor, in reality, is that the path of travel of the flue gases must be as long as is consistent with good design and must be maintained at a sufficiently high velocity to provide scrubbing action against the various surfaces. The higher the velocity, the lesser the effect of the film of air adjacent to the combustion section and the more rapid the heat transfer from the flue gases to the furnace or boiler.

The boiler efficiency is a function of the mass of the boiler and the water it contains. Naturally, massive boilers with large water quantity require more heat to raise their temperatures only to have the heat lost up the stack during the off cycles. In addition, the boiler must be designed to have a minimum of losses from the exposed surfaces so as to avoid overheating the space immediately adjacent to it and thus increase the operating cost due to these losses.

### Burner

Several of the functions of the burner are not directly related to the combustion process. These are (1) the

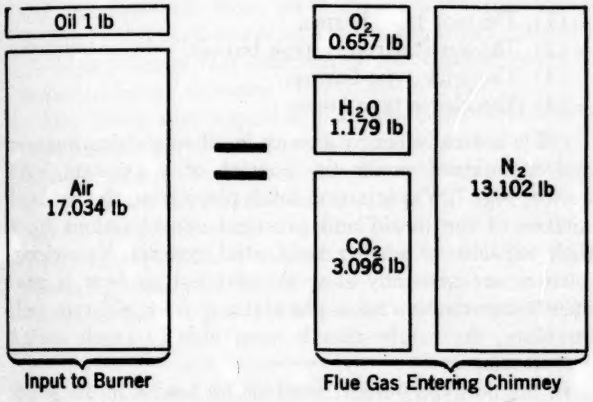



Fig. 2. Products of combustion resulting from combustion of one pound of fuel oil, and with $CO_2$ at 12.5 per cent.

delivery of the oil from the tank to the heating unit normally by the suction lift of the pump, but occasionally by gravity with the accompanying dangers and (2), the delivery of oil from the pump to the nozzle or the place where the oil is burned.

In delivering the oil from the pump to the nozzle, some burners mix a small amount of air with the oil, breaking it up into fine particles (atomization) to insure more complete combustion. The small quantity of air used in the atomization process has little effect on the overall air required for combustion and the only effect of this air is to make it easier for the combustion air to have more intimate contact with the oil particles. In this way the air used in the atomization process has only an indirect effect on the $CO_2$ and stack temperature.

The primary function of the oil burner is to convert the liquid oil from a liquid to atomized particles or a gaseous state and to both arrange and control the mixture of this prepared oil with air to permit the chemical reaction to take place. There are two basic types of oil burners.

(1) Liquid is converted to a gas by the application of heat alone.

(2) Vaporization takes place as a second of two stages —first, the oil is atomized or broken into fine droplets,

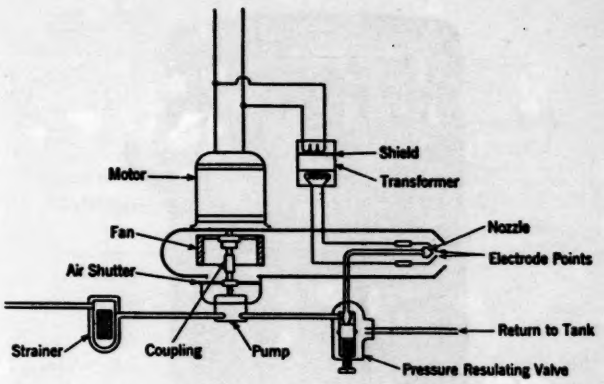



Fig. 3. Schematic drawing of high pressure atomizing burner.

and second, the fine droplets of oil are exposed to the heat in the chamber and vaporizaton takes place from the surface of the droplets.

### Atomizing Burners

The atomizing burner consists of a pump with a driving motor, a nozzle, and a blower. The pump draws oil from the storage tank, pumps it to a pressure of approximately 100 psig and forces it through the nozzle, frequently in a spiral fashion which gives it a rapid whirling motion. The oil is broken into small particles by sudden release of the pressure as the oil emerges from the nozzle orifice.

Air from the fan is introduced through an air tube which completely surrounds the nozzle. Mixing of the atomized oil with the combustion air occurs just beyond the nozzle. Frequently a whirling action is also introduced in the air tube in the opposite direction from that of the oil spray to improve the mixing, but once the air leaves the burner tube, it travels in a straight line—the swirling pictures shown in advertisements are generally artists' dreams.

The oil vapor mixed with air is ignited by the electric spark between the two electrodes located near the nozzle tip, but generally out of the oil stream. Constant ignition is normally not used and the electric spark is de-energized after a time delay for starting. Fig. 3 is a schematic diagram of a high pressure atomizing burner.

Oil droplets introduced into the combustion chamber are surrounded by air. The liquid on the outer surface of these small droplets is progressively boiled away as new layers become exposed. By progressive vaporization, these fine drops are completely changed to a gas. The temperature of the mixture must be sufficiently high to insure continuous combustion. However, when excessive temperatures result, the oil when still in a liquid state will be caused to crack and form solid carbon much the same as occurs when the oil is in a gaseous state but lacks sufficient oxygen for combustion.

It is important then that a nozzle be selected to provide a flame shape consistent with the combustion chamber. This is discussed later in more detail. It is further desirable that the droplets from the burner be of equal size and the spray uniform so that all droplets will vaporize at about the same rate. If the spray is not uniform, for example one-sided, it is practically impossible to control the air required for combustion.

A low pressure atomizing burner is similar in many

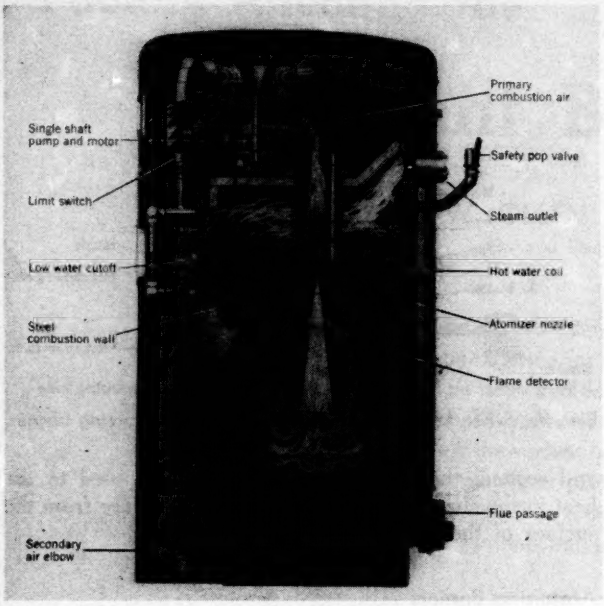



Fig. 4. Low pressure atomizing burner firing vertically downward.

respects to the high pressure burner except that rather than employing pressures in the range of 100 psig, the oil pressure at the nozzle is 15 psig or less. In the low pressure atomizing burner, atomization is accomplished by the sudden expansion of the mixture of oil and compressed air. Atomizing air is usually provided by the same pump that supplies the oil to the nozzle, this pump usually being the rotary vane type.

Ignition is normally accomplished in exactly the same way as in a high pressure atomizing burner and combustion takes place in a combustion chamber similar to those employed with high pressure gun type burners.

Various low pressure burners available to the trade bring in the combustion air by different methods. Some or all of the air for combustion is introduced through a concentric tube around the nozzle. One major manufacturer introduces the majority of the air as a secondary stream opposing the air-oil mixture after combustion has started. This in reality turns the flame inside-out and puts air in contact with the oil particles that have up to this point been blanketed by the outer shell of burning oil. This insures that all oil droplets have adequate air without having an over-excess present and allows high $CO_2$ while still maintaining a clean fire. See Fig. 4.

Another method of atomization is the use of a vertical rotary atomizing burner. Oil is atomized by discharging it from the edge of a rapidly revolving cup driven by an electric motor. Centrifugal force causes the oil to discharge from the upper edge against a directing plate. Upon being thrown from this whirling plate, it meets air directed from above and below by two sets of fan blades. Ignition is generally accomplished by an electric spark located about an inch from the edge of the cup. The vertical rotary atomizing burner employs an impeller type fan and the horizontal burner a centrifugal type.

The horizontal rotary cup burner shown in Fig. 5 uses a centrifugal fan because it requires a higher velocity air stream to pick up the atomized oil as it leaves the rotating cup and deflects it to form a horizontal spray. In deflecting the stream, the air should mix thoroughly with the oil.

Occasionally compressed air or high pressure steam is used in industrial oil burners for atomization. This is more typical in heat treating processes and miscellaneous processes where a great deal of flexibility is required.

### Vaporizing Oil Burners

Vaporizing oil burners are of four distinct types.

(1) The pot type burner.
(2) The vertical rotary type burner.
(3) The wick type burner.
(4) The sleeve type burner.

Oil is normally fed by gravity in all vaporizing burners and maintained under the control of a constant level device, Fig. 7. Vaporization takes place from the exposed surface of the liquid and practical considerations limit their capacity to smaller residential systems. Vaporizing burners are generally slow to start but as heat is produced, vaporization takes place at a more rapid rate and, therefore, the combustion is soon able to reach design performance.

In the pot-type burner, combustion begins in the lower portion of the chamber and is completed in the upper portion and above the chamber, as shown in Fig. 6. Pot-type burners consist of a metal combustion chamber into which oil flows to form a thin film on the surface—vaporization takes place from the surface, establishing a zone of gasified fuel oil. Air is admitted through ports in the upper portion of the chamber walls mixing with the gas. A constant low flame is required to insure sufficiently rapid pickup. This may tend to overheat the home in mild weather. Since such low ratings are possible, fairly adequate efficiencies can normally be maintained throughout the heating season.

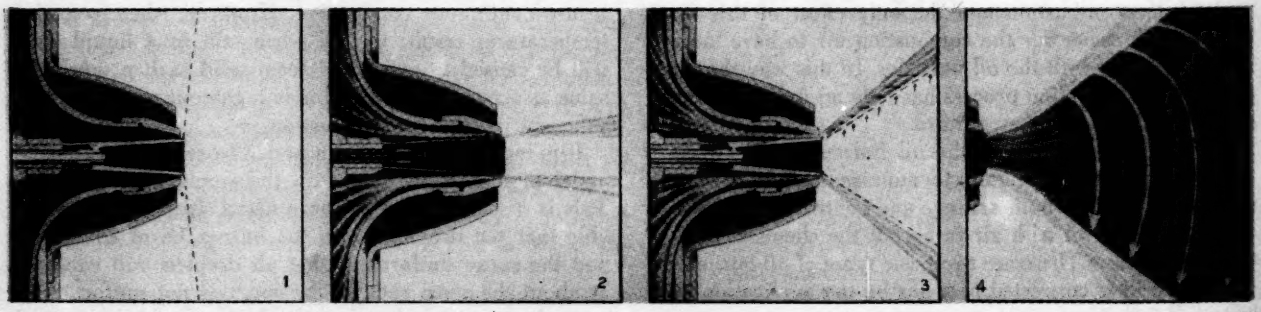



Fig. 5. Action of a rotary atomizing burner: (1) With no air through burner, air is thrown away from cup. (2) With no oil through burner, primary air moves out as indicated. (3) In actual operation, oil and air meet off the edge of the cup. (4) Air passes over the outside surface of the cup through vanes to produce rotation of the air column.

The rotary type vaporizing burner, uses a vertical motor, a blower, an oil distributor, and a vaporizing ring. The vertical motor is mounted above it; on its shaft is an oil distributor from which oil is delivered radially out to the vaporizer ring. Vaporization results when the oil particles heat the refractory of the ring. The vertical motor rotates a blower with the distributor to deliver air and mix it with the vaporized oil upon contact with the refractory ring as shown in Fig. 8. The quantity of air supplied determines the distance above the ring where combustion takes place.

The wick type vaporizing burner, Fig. 9, is primarily used in kerosene lamps and small kerosene cook stoves. With this type burner, combustion takes place at the upper edge of the wick much as with a cigarette lighter. The wick extends into a reservoir containing the fuel. The wick remains constantly wet with the fuel and exposure to flame vaporizes the liquid igniting the small portion that has been drawn to the surface by capillary attraction. Vaporization continues due to the continuous heat produced by the burning of the vapor at the top of the wick. The air for combustion is by gravity through an enclosed chimney through which the air rises and is heated. The more rapid the rate of combustion, the greater the heating and, therefore, the more rapid the air travel through the chimney. A clean flame results unless the wick is turned to the high point so that sufficient air for combustion is not drawn in by the chimney effect of the burner.

The sleeve type vaporizing burner consists of several troughs into which oil flows by gravity and the level is maintained by a leveling device. Each trough is enclosed by perforated concentric sleeves and a flat wick is set on each in the center of the trough. This is shown in Fig. 10. These wicks, which extend above the level of the liquid becoming saturated much as in the wick type burner discussed before, provide evaporative surface for vaporization. Air for combustion is introduced through small holes in the cylinder wall. This air mixes with vapors from the surface of the liquid and from the large flat wicks. Combustion takes place in the spaces above the wicks between the various concentric sleeves. When the sleeves become hot, the rate of evaporation is increased and combustion takes place slightly above the wicks.

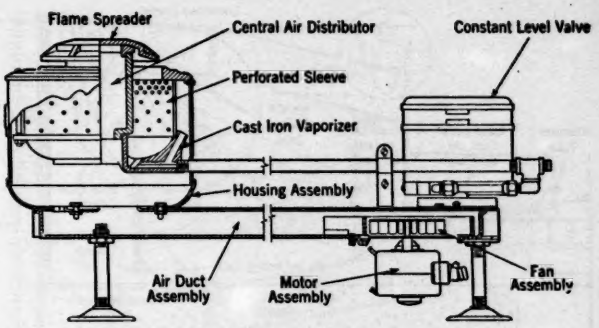


Fig. 7. Constant oil leveling device.

Regardless of the type burner used, it is apparent that proper mixture of the oil and the air are essential for clean, efficient, complete combustion.

## Burner Head

In an atomizing burner, the burner head is of major importance in the efficiency of the burner and the running, not the seasonal, efficiency of the entire heating plant.

The other parts of the burner carry the air and the oil to the burner head, in some cases doing part of the preparation for atomization. In the burner head the preparation for atomization is completed, and as the oil leaves the burner head, atomization occurs.

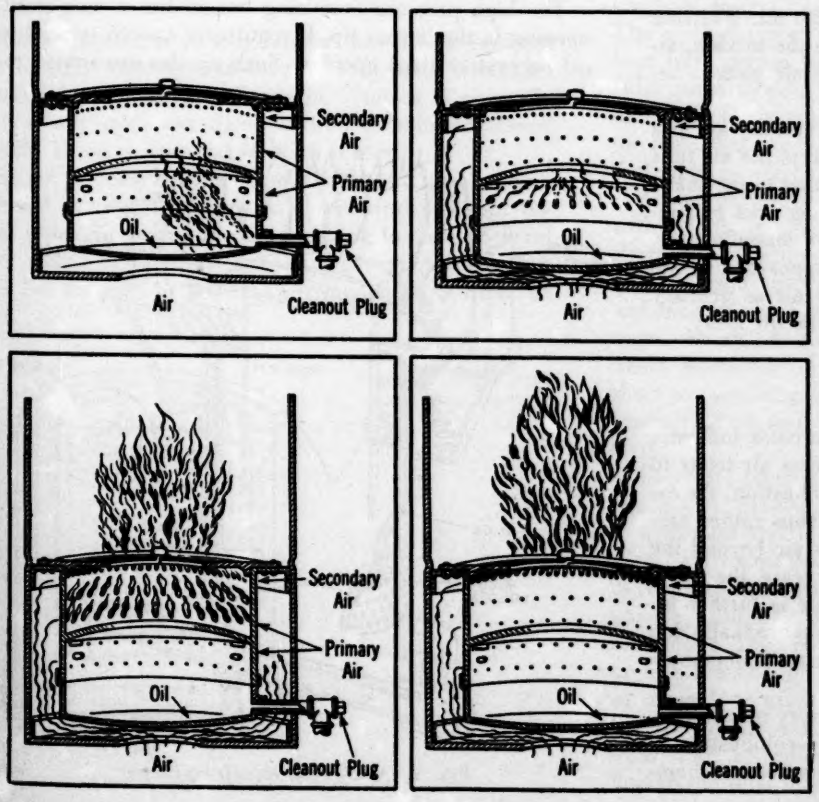


Fig. 6. Four combustion stages of the vaporizing pot type burner.

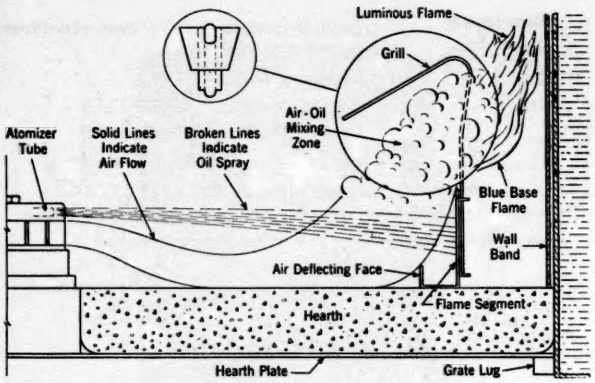



Fig. 8. Details of a rotary type vaporizing burner.

The burner head must be designed to insure intimate mixing of every particle of oil with just the right amount of air to burn it completely with a minimum amount of excess air. When too little air is supplied or does not contact the oil particles, the oil is not completely burned and carbon or soot is formed which has the same effect on the operating cost as unburned coal in the ash pit of a coal furnace. Addition of air through the burner head or a controlled supply of air from another source may reduce the soot, but excess air carries with it wasted heat up the chimney. The flame should be adjusted so that it is just on the verge of being smoky. Excess air may accomplish this cleaning-up of the fire but it is not a satisfactory substitute for thorough atomization and mixing of every particle of oil with air.

The high pressure atomizing burner head has two parts—the nozzle, and the air vanes to direct the air to impinge on every particle of oil as it leaves the nozzle. This air requires precise control as to both quantity and direction with respect to the oil leaving the nozzle. Air must be directed at and must surround the oil. Whirling the air in the tube does little to improve the mixing, although it does more or less establish the air pattern beyond the nozzle.

The usual method is to introduce high velocity air in a properly directed air stream so that it leaves the air tube in the form of a wide angle cone conforming to the shape of the oil spray. This increases the burning area and insures a maximum of mixing. One major manufacturer, however, introduces most of the air in opposition to the oil stream, using only about 15% of the air as primary air introduced in the same direction as the oil spray.

## Effect of Air on Flame Size

A harsh flame which is almost white in color indicates an excess amount of combustion air. Excess air tends to shrink the flame and make for noisy combustion. As excess air is increased, the per cent $CO_2$ drops rather uniformly. Increasing the quantity of excess air beyond the absolute minimum at first tends to increase the stack temperature. As the quantity of excess air is further increased, the stack temperature tends to drop gradually due to the chilling effect of the extra air entering the combustion section at room air temperature.

A smoky flame is usually a rolling and very quiet flame. The oil is not being completely burned—combustion is not completed within the confines of the combustion chamber because sufficient oxygen is not available within the chamber and thus the oil particles drift out hoping to find oxygen. The temperature is generally too low outside the combustion chamber for complete combustion. The oil particles leave the region of proper combustion temperature before finding enough oxygen. They are thus chilled forming soot.

Other factors involved in the flame shape are air leaks, excess drafts, fire box shape, boiler not designed for oil, plugged or worn nozzle, coarse atomization, or dirty flues. Many of these points are covered later in this article.

It is of utmost importance to make certain that the air pattern is designed for the flame pattern so that the air supply completely surrounds the flame and all components used in this system are designed to work together. It is difficult to expect the burner of one manufacturer to work in a really efficient manner with the boiler or furnace of another manufacturer and a combustion chamber of still another.

## Oil Rate

There is only one oil rate for which a unit can be designed for maximum efficiency. Components can be modified but efficiency is sacrificed. To get the most out of any flame it must conform with the unit in which the burner is operating.

Oil rate, of course, is a function of the metering device. In a vaporizing burner, this is normally a leveling device of some type. In atomizing burners, oil rate is a function of pressure and nozzle orifice size. Regardless of the type burner installed, the unit should be fired at the rate recommended by the manufacturer. The unit should not be overfired if design life and efficiency are to be obtained. The major effect of underfiring is to reduce seasonal efficiency.

The high pressure atomizing burner has a very small opening in the burner tip. It requires a smooth symmetrical accurately sized opening. Such nozzles are subject to

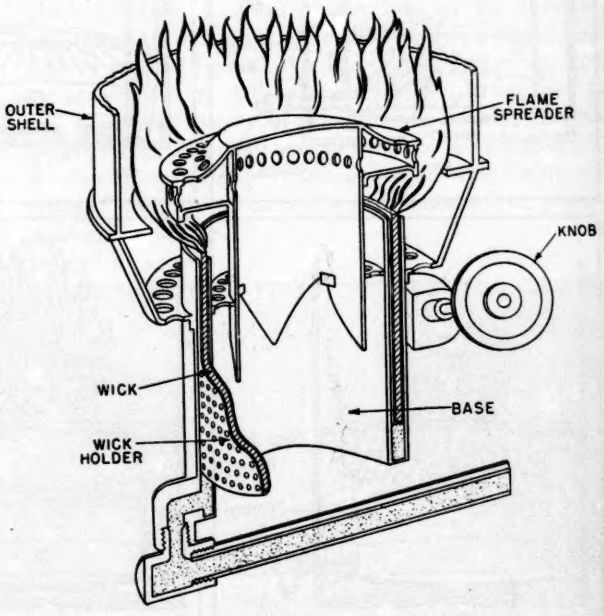



Fig. 9. Wick type vaporizing burner.

being blocked or partially blocked by minute particles so that the flame is distorted or completely stopped if the filter fails to remove all the fine particles.

In the low pressure atomizing burner, a much larger orifice is used because of the lower pressure. A given sized imperfection in the orifice is, therefore, not as important since it is smaller in proportion to the area of the opening. Small particles pass through the tip and the flame pattern is not so readily interfered with by small particles of foreign material.

There is little chance of interrupting the flow of oil due to small unfiltered particles when the vaporizing burner is used. The problem, and it is recognized that it is not one that occurs frequently, is failure of the metering device or leveling device. This can cause gravity flow of oil from the tank to the combustion chamber, resulting in overfiring on start-up.

### Maintaining Burner Pressure

Variations in pressure materially effect performance. When oil pressure varies, the air-oil ratio cannot be accurately maintained for a constant $CO_2$ and stack temperature. Firing any unit at more than one oil rate usually means excess air and low efficiency at the low oil rate.

All atomizing burners have adjustments for the pressure. This pressure should be adjusted as recommended by the manufacturer to insure rated oil flow.

### Ignition

Many methods are employed to ignite the oil. In vaporizing burners, the unit may operate at a low rate or employ a gas pilot to keep the combustion section somewhat warm so that more rapid ignition and complete burning will be insured for such time when the thermostat calls for heat.

Most residential atomizing burners use electric ignition and a high voltage transformer with two electrodes mounted just out of the oil stream. Ignition is normally applied only until the flame is well established. Occasionally, however, constant ignition is used.

Electric ignition has the advantage that no heat is being delivered during off periods to cause overheating of the space when the thermostat is not calling for heat. Several other means of ignition such as a gas pilot have been used, but the pilot or low rate for vaporizing burners, or electric spark ignition for atomizing burners are the most common.

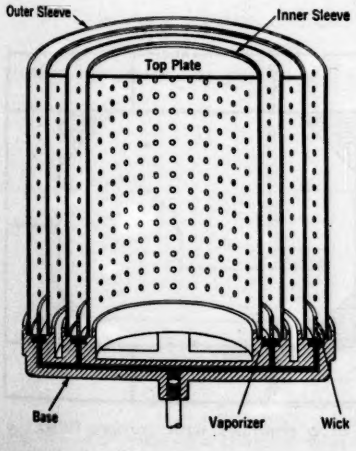



Fig. 10. Sleeve type vaporizing burner.

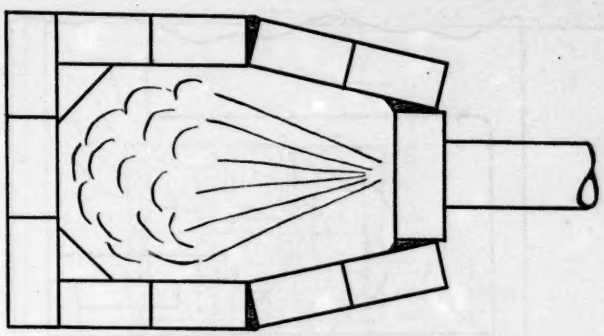


Fig. 11. Sketch of a tapered chamber.

### Materials for Chamber

Since the functions of the chamber are primarily to confine the flame and reflect heat back into the oil, the chamber can be made of any material that will perform these jobs while at the same time having a suitable life under the conditions of operation. These conditions are not too easy to meet, since there is high temperature, an oxidizing atmosphere, and alternate heating and cooling of the chamber.

Ceramic or fire-brick chambers are the commonest materials used, with a few burners making use of metal liners which serve the same purpose as ceramic chambers. The only reasonably priced metal that will stand up for any length of time when used purely as a chamber liner is stainless steel. Some warm air furnaces, where the furnace itself is designed especially for the size and shape of the flame, concentrate the flame so that no inner combustion chamber liner of ceramic or stainless steel is required. The main chamber wall itself reflects enough heat, but is kept from getting too hot by proper airflow over the outside. Some models have extensive fins on the outside to more effectively transfer the heat to the air. By keeping the metal below critical temperatures, the life of it is such that stainless steel is not necessary in this application.

An advantage of the stainless steel liner is the speed with which it reaches operating temperatures, greatly shortening the interval during which the radiant heat reflected back into the oil stream is below normal value, and thus reducing the time during which the oil may not burn cleanly. A disadvantage of these metal reflecting liners is shorter life, particularly becoming increasingly short as overfiring increases. Another point is that unless carefully designed, there may a tendency to buckle or warp.

There are many ceramic materials in use, mainly varying in their density, and in the temperature they are able to withstand over long periods. Very light brick is a comparatively recent development, and has the advantage over the heavy, dense brick in that they come up to temperature quickly, although probably not as quickly as stainless steel liners. They have a further advantage in not soaking up as much heat on each run, and therefore, do not waste as much heat after shutdown by giving up their stored heat to the air passing through the furnaces due to natural draft conditions. Any step in the direction of reducing the total mass of material that must be heated on

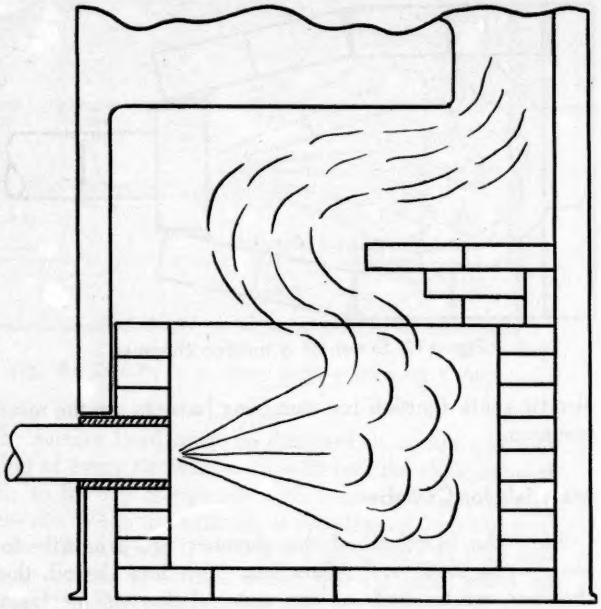


Fig. 12. Side view of a furnace and chamber with corbel.

each run is a step toward reducing the overall standby loss. More about this point later.

A heavy chamber that requires a long time to come up to operating temperature may easily cause considerable carbonizing in mild weather. This is particularly true with boilers when operating on domestic water cycles. In other words, on boilers the water-temperature switch, or on furnaces the thermostat, may become satisfied before the efficient burning stage has been reached on each start, leaving a small deposit of carbon for each run. The carbon left on the firebrick will, of course, burn off on the first long run, but the carbon deposited in the furnace passages cannot burn off, since these surfaces never reach the kindling temperature of carbon. The end result is that more frequent boiler cleaning is necessary. Remember that a film of carbon is a good insulator, and rapidly reduces the heat absorbing ability of the surfaces that it covers.

### Shape of Chamber

There is no shape of combustion chamber that is necessarily better than any other. The important point is that the chamber should be of proper dimensions to suit the shape of the flame. Since in most cases, the shape and size of the chamber are dictated by the boiler dimensions, it is customary to select the nozzle to give a spray pattern that best fits the chamber. Where some leeway is possible in the shape of the chamber, one that tapers toward the nozzle, Fig. 11, more nearly meets the requirements of matching the shape of the flame.

A corbel or overhang, as shown in Fig. 12, further aids in clean combustion by reflecting more heat back into the incoming oil. It often has a further benefit where the gases enter the secondary surface at the rear of the boiler by lengthening the path of travel of the gas, also shown in Fig. 12. This allows a little more time for the oil to finish burning before entering the secondary passages where there is danger of the partially burned oil "condensing" on the relatively cool surface. Another advantage will be discussed under the section headed Boilers and Warm Air Furnaces.

Until considerable experience is gained in building fireboxes, it is always wise to follow the recommendations of the burner manufacturer, or lacking these, use the guide book of a reputable firebrick manufacturer.

Where the boiler or furnace has been designed by a single manufacturer, and is sold as an integrated, complete unit, there is no problem of deciding on the size and shape of the combustion chamber—it has been carefully engineered by the manufacturer and supplied as part of the unit. Such units, in general are the most economical over a complete heating season, because the single manufacturer has control of all factors entering into the burning of the oil, absorption of the heat released, and the various factors affecting standby loss.

### Troubles Due to Poor Chambers

A poor chamber may be the cause of several more or less related troubles. For instance, a chamber too large will result in poor vaporization of the oil particles through lack of enough reflected heat, which in turn can account for smoky, incomplete combustion. Or if an attempt is made to clear up the smoke by opening up on the combustion air, there results a harsh fire with low $CO_2$. A harsh fire in turn is usually noisy.

A chamber too small can have equally bad effects. Either the oil is not far enough advanced in the burning stage before leaving the combustion chamber, or else too much combustion air must be admitted to shrink the fire to fit the chamber. The former forces unburned or partially burned oil into the secondary surfaces where part of it is deposited, while the latter again results in a harsh fire with low $CO_2$.

Both low $CO_2$ on the one hand, and incomplete combustion on the other, contribute to poor efficiency and excess oil consumption.

### Flame Pulsation

Sometimes an improper chamber causes or aggravates flame pulsation. On the other hand, a chamber that is perfect for a given nozzle and oil rate in one boiler, will show up with flame pulsation in another. Here the trouble is obviously in the boiler itself, but often a slight modification in the chamber will help the situation. One can never be sure just what will be effective, but some changes to try are:

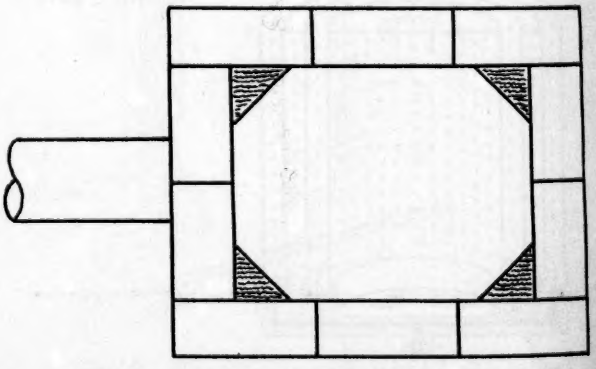


Fig. 13 Top view of a chamber with corners filled.

(1) Fill in the corners, if the chamber is square or rectangular, as in Fig. 13.
(2) Deepen corbel.
(3) Change shape by narrowing or shortening.

Perhaps the most consistently successful means of reducing combustion pulsation is the use of a breather tube in the front wall of the chamber as in Fig. 14. This must be applied with caution, since if the overfire draft is positive, fumes will be forced into the basement, and if the overfire draft is too much in the negative direction, considerable cold air will be drawn into the chamber. This air will not necessarily aid combustion, and may even chill the flame at that point. In any case, this air reduces the $CO_2$. However, if the installation has the proper overfire draft of about 0.02 inches of water, then there will be little effect on the combustion. Some loosely packed steel wool in the tube will reduce the possibility of any carbon particles being pushed out on start-up.

The action of this breather tube in reducing pulsation can be likened to the detuning of an instrument. Oil may often burn with a slight but natural frequency or pulse as described later under Combustion. When the boiler and chimney are such as to be in resonance with this frequency, the pulse is amplified and reinforced. The breather tube changes the resonance of the boiler-chimney combination so it no longer reinforces the slight pulse of the flame, and the trouble is eliminated. The effect of the breather tube in changing the pitch of the boiler and chimney is much the same as the note emitted by a clarinet, which is changed when a finger is raised to open another hole.

## Combustion

It should always be remembered that it takes the combination of a good burner and a good chamber to insure good combustion. Neither one alone can burn oil properly. One sees in an advertisement claims of marvelous combustion because of for instance, "our Super-Roto-Regenerative Nozzle with Pretzel Action." The company completely ignores the fact that the combustion chamber can make or break the performance combustionwise.

On the other hand, firebox manufacturers are prone to claim just as marvelous results for, let us say, their "Churnemup-Burnemup Chamber with the Dynamic Diverter." If these two manufacturers ever got together, it would be quite a burner!

The process of burning oil involves four factors:

(1) Preparing oil for combustion, i. e., breaking it up in the form of a spray.
(2) Vaporizing or gasifying the oil.

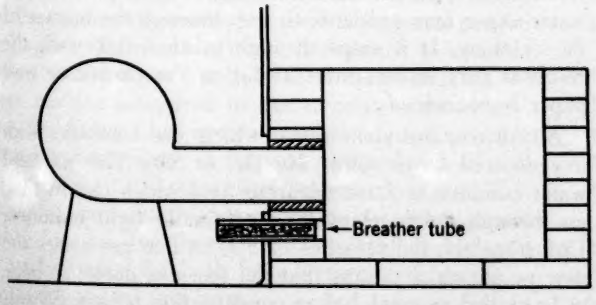



Fig. 14. Side view of a chamber with a breather tube installed.

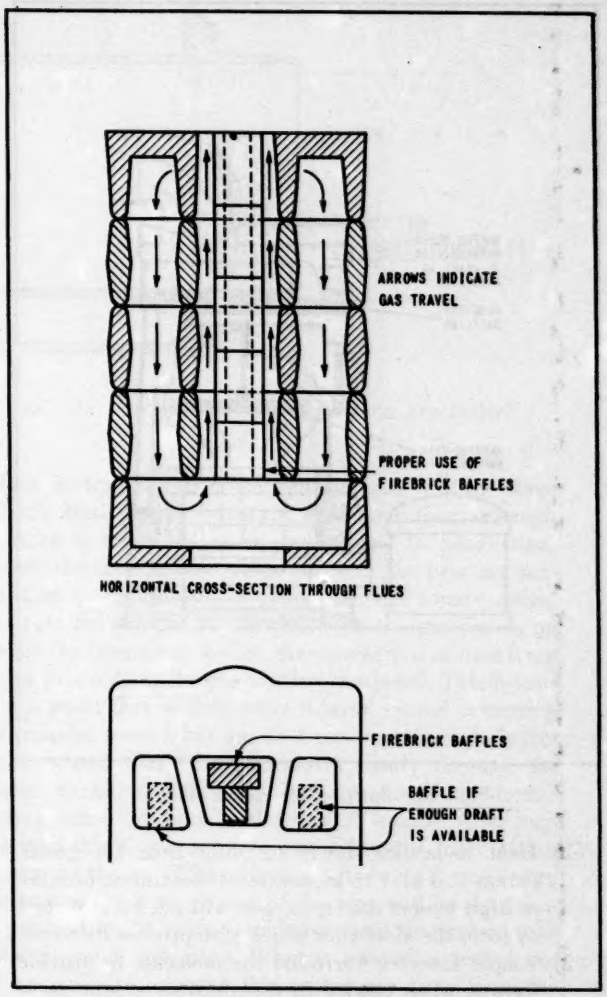

ARROWS INDICATE GAS TRAVEL
PROPER USE OF FIREBRICK BAFFLES
HORIZONTAL CROSS-SECTION THROUGH FLUES
FIREBRICK BAFFLES
BAFFLE IF ENOUGH DRAFT IS AVAILABLE

Fig. 15. Baffling for rectangular boilers.

(3) Mixing oil vapor and air.
(4) Igniting and burning the mixture.

From the point where the oil is broken up, it is interesting to follow the process of combustion. First of all, remember that the raw oil itself in droplet form does not burn, but rather that the oil is vaporized by the heat present and burns as a gas or as carbon as we shall see. Since oil is composed basically of hydrocarbon molecules —in other words, various combinations of hydrogen and carbon—the end products are the result of oxygen combining with each of those to form water vapor or $H_2O$, and carbon dioxide or $CO_2$. You will recognize $CO_2$ as the factor that indicates how good your combustion is, but did you know that for every gallon of oil burned, over a gallon of water goes up the chimney? You probably do if you ever had a big, cold chimney and a low oil rate that gave chimney condensation troubles.

Hydrocarbons can burn by either of two processes: aldehydous or carbonic. Don't let those throw you—aldehydous is blue-flame combustion—much like in a gas stove, while carbonic is yellow-flame combustion, which is more common in pressure type oil burners.

In the blue-flame process, combustion is completely gaseous, therefore quiet. Since no free carbon is released in the process, no soot is produced. To have this type of combustion, three general requirements must be met:

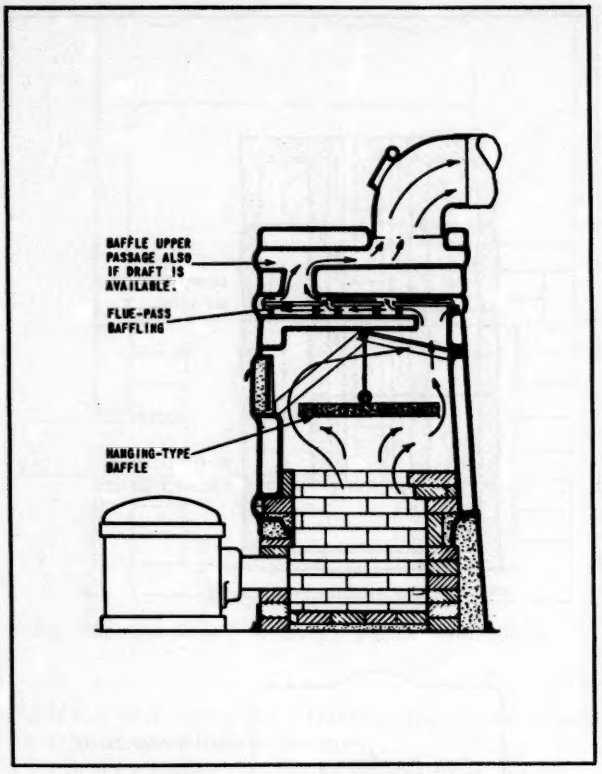



Fig. 16. Baffling for round boilers.

(1) Heat molecules slowly to allow time for gasification and heat to moderate temperatures, because at high temperatures, oxygen will not be absorbed to form the aldehydes which give process its name.
(2) Ample air must surround the molecule to provide oxygen when needed in the absorption process.
(3) The hydrocarbon must be of the less stable chemical structure since the more stable structures will not absorb the oxygen to form aldehydes.

In carbonic or yellow-flame combustion, the molecule is heated to high temperature and broken down into carbon and hydrogen, which then combine directly with oxygen. It is the burning of the carbon that gives the flame its yellow appearance; since the action takes place faster and at a higher temperature, this type of combustion will be noisier than the blue-flame. Soot will be produced if combustion is stopped before completion, such as by the flame touching a cold surface.

Any hydrocarbon can burn with a yellow-flame, but only certain varieties can burn with a blue flame. With any given oil, some of each type of combustion will occur. Catalytic or "cat" oils, because they have a higher proportion of the stable hydrocarbons, have a greater tendency to burn yellow, are harder to burn clean, and more likely to form soot.

Catalytic oils have less hydrogen (since the "cat" process uses more of the hydrogen in the crude oil to make gasoline) and this also accounts for the tendency of cat oils to burn dirtier, in this way: The water vapor developed reacts with free carbon at high temperatures to form hydrogen and carbon monoxide which both burn as a gas, thus reducing the amount of carbon burned directly to $CO_2$. Therefore, when the oil has less hydrogen, there is less water vapor present to aid in this "cleaning-up" of the combustion. However, do not attempt to remedy this situation by adding water to the oil tank.

The ability of some oils to burn both carbonic (yellow) and aldehydous (blue) can result in flame pulsation. Suppose the flame establishes as blue. As it burns the heat released heats up the oncoming oil stream at a faster rate so that the oil begins to burn carbonic. Carbonic combustion has a higher flame velocity, so the flame will now burn closer to the nozzle. Now, however, the oncoming oil does not have as much time to heat up, so it will revert to a blue flame which then moves away from the nozzle. As this process repeats, it produces a pulsating effect. This effect is not the only reason for flame pulsation.

As noted, the carbon in the oil burns to carbon dioxide, which all oil burner men call by its chemical formula, namely $CO_2$. It is the per cent $CO_2$ in the flue gas that is a measure of the combustion efficiency, and the higher the $CO_2$, the higher the efficiency. Obviously, the actual amount of $CO_2$ is fixed, since oil is pumped in at a fixed rate giving a definite number of pounds of carbon to be burned. Therefore, a definite number of pounds of $CO_2$ would be formed. If this carbon burned to $CO_2$ completely, and there were no free oxygen at all left in the mixture, the per cent $CO_2$ in the flue gas would be about 15. It is obviously impossible to have just the right amount of oxygen present. Actually, there must be some excess in order that every molecule of carbon and of hydrogen can combine with oxygen within the combustion chamber. If they are not able to get oxygen in the chamber at the burning temperature, they will not be able to combine after they get out into the relatively cooler part of the furnace. The excess air that must be put into the fire to insure oxygen where and when needed, dilutes the definite number of pounds of $CO_2$ gas we can produce, and thus the per cent $CO_2$ is lowered. This lower per cent $CO_2$ indicates lower efficiency since every pound of excess air put in is heated up and goes up the chimney carrying useful heat with it. The more excess air that must be used to clear up a smoky fire, the more heat is wasted up the chimney. This is one reason why it is so important to have the chamber right for the flame: so that the oil can burn clean with a minimum of air, and the least loss up the stack. As mentioned, lots of excess air generally produces a harsh, noisy flame.

We have seen that the hydrogen in the oil burns to form $H_2O$, or water vapor. If the flue gases pass over a cold surface, this water vapor will condense out much as water droplets form on a glass of ice water. Some condensation may occur in any chimney on a cold start, but as soon as the chimney warms up sufficiently this moisture will re-evaporate. Sometimes, however, when the chimney is large, and slow to warm up either due to its mass or to a relatively low oil rate and low stack temperature, enough water vapor may condense to seep through the mortar of the chimney. If it seeps through to an inside wall, the result is very undecorative as far as the plaster or wall paper is concerned.

All oil contains some sulfur which also combines with oxygen, and forms sulfur dioxide, or $SO_2$. This gas and water combine to form sulfurous acid which can in time go through the mortar of an originally tight chimney. Unfortunately, the presence of $SO_2$ in flue gas raises the dew point, which means that the flue gas does not have to be chilled as much before condensation occurs. So sul-

fur in the oil has a doubly bad effects for (1) condensation occurs easier, and (2) the condensate is more acid, and thus more harmful to the mortar of a chimney.

If the chimney is properly built with a tile or ceramic liner there will probably be no harmful effect from condensation. On a converted coal job, however, where the chimney probably has no liner, it is not always advisable to try for the lowest possible stack temperature, particularly if the oil rate is low. Note that it is not actually the flue gas temperature that is important where condensation is concerned, but rather the amount of heat going up the chimney. It is obvious that for a given $CO_2$ there will be more heat up the chimney at 400F stack and 3 gph than at 700F and 1¼ gph and therefore more liability of condensation with the latter. Naturally, both these combinations could not be obtained on the same furnace, but might occur on different furnaces connected to more or less identical chimneys.

Many schemes have been proposed, and many are in use, for taking more heat out of the flue gas before it goes up the chimney. Most of these devices are inserted between the furnace and the chimney inlet, and can actually lower the gas temperature an appreciable amount, depending on the size and complexity of the unit. Aside from the problem of chimney condensation, the proponents of these heat-absorbers usually fail to take into account the law of diminishing returns. It is easy to see that as the gas temperature is reduced, the difference in temperature between it and the air or water that is removing the heat becomes less and less, and thus to remove a given amount of heat requires more and more surface. This makes the absorber increasingly expensive to build to get the last of the heat. A point is reached somewhere along the line where the increased efficiency due to lower stack temperature cannot save as much in fuel cost as the interest on the additional investment. This does not mean there are no cases where additional surface is worthwhile. We shall see in the discussion on Boilers and Warm Air Furnaces that many installations are bound to have high stack temperatures and could well use more heat-absorbing surface for a big saving in fuel.

### Boilers and Warm Air Furnaces

Heat released by the burning oil is transferred through the material of the boiler or furnace—steel or cast iron—and picked up on the other side by air or water. This transfer takes place in two stages: Through the primary surface, which is the area surrounding the combustion chamber or in general the surface that directly sees the flame; the secondary surfaces do not see the flame, and in general are the passages through which the hot gas passes to get from the combustion chamber to the flue outlet.

The ratio of primary and secondary surfaces varies with different manufacturers, but there is a general pattern depending on what fuel the boiler is designed to use. For instance, coal furnaces will have a large amount of primary surface compared to the amount of secondary, while a gas furnace has a very small amount of primary compared to secondary. A furnace designed for oil will generally have a ratio somewhere between these two. This explains the somewhat higher operating cost when a unit designed for one fuel is converted to another fuel and when performance for both fuels is sacrificed when trying to make a dual fuel unit.

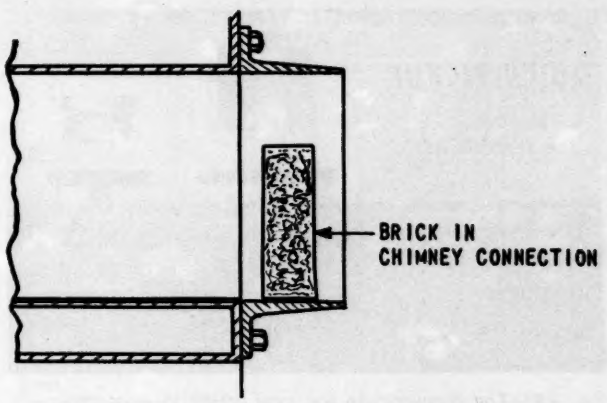



Fig. 17. Improper method for baffling any boiler.

Heat is transferred from the burning oil by three methods: Radiation, conduction, and convection, although the latter is more or less a preliminary to conduction. Most of the transfer that takes place to the primary surface is by radiation, but of course there is some conduction from the hot gas to the metal. As the gas moves on through the furnace or boiler, the conduction of heat from the gas proceeds as the gas touches the metal. This brings up to a point that is frequently misunderstood regarding heat transfer from a hot gas to a metal surface: It is frequently stated that "the gas moves slowly through the furnace to allow plenty of time to absorb the heat." Nothing could be more misleading! Visualize what happens with this slowly moving gas. When the layer of hot gas next to the metal has given up its heat, there is very little reason for it to get out of the way and let more hot gas get next to the surface, so it blankets the surface with a film of good insulation. What is needed is turbulence and gas velocity to scrub this cooler gas away from the surface to let more hot gas get in close and give up its heat. Actually, the higher the gas velocity over a surface, the faster the heat transfer because the high velocity effectively scrubs away this insulating film of cooler gas.

As soon as this concept is clear; we can see the reason for various kinds of baffles in furnaces. They are not installed to hold back the gases but rather to make the gases rub closer to the surface. Realizing this will also help to understand how to do a good baffling job.

In a coal furnace converted to oil, the secondary passages are usually too large, so that the gas drifts through slowly. The passages had to be large and of low pressure for coal, since with coal the furnace operated on natural draft and the available draft could not be wasted in pressure drop in the secondary. With the oil burner, however, all draft except about 0.02 inch of water, is available for overcoming secondary pressure drop. Fig. 15 and 16 show two different methods of baffling.

Another common baffle is the type hung over the fire box, also shown in Fig. 16. This one has a double effect: It reflects heat back into the burning oil, and also forces the gas out to the periphery of the space where it is forced to scrub the surface more closely than would otherwise be the case.

The phrase "hold back the gas" is heard often—sometimes from sources that should know better. A little thought will show that the gases cannot be held back, for oil is entering at a fixed rate, air is being supplied at a

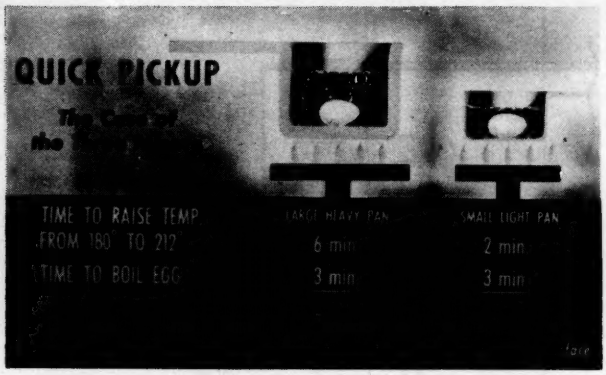



Fig. 18. The three-minute egg application to illustrate quick pickup.

fixed rate, and thus combustion products are being produced at a fixed rate. They must leave at the same rate, with or without a baffle to hold them back. What actually happens is that with such a baffle (for instance, a brick in the flue outlet, as shown in Fig. 17 has been suggested) the pressure in the furnace or boiler builds up slightly until it is sufficient to force the gases out past the brick at the same rate as before the brick was inserted. Nothing is gained, and the danger of oil odors is increased because of the higher pressure that develops in the combustion chamber.

The heat absorbing surface in a boiler or furnace may be in many forms and shapes, but fundamentally, the efficiency of the surface is a function of the total amount of surface, and the turbulence and velocity of gas over that surface. The turbulence may be caused by the surface itself, such as fins, pins, or knobs on the surface, or by folding the flue passes to make the gas turn corners often. A spiral baffle in a firetube is a good example of a means of creating turbulence, and of causing a rapid interchange of the gas closest to the heat absorbing surface.

It must be remembered that in creating turbulence, and in raising the gas velocity, we are causing pressure drop. If we are to keep 0.02 inch negative pressure in the combustion chamber to prevent outward leakage, then we can baffle the secondary only to the extent allowed by the available draft over and above this 0.02 inch. However, on a unit of integrated design, where all joints are sealed against leakage by proper gasketing, it is of no importance to maintain negative pressure. From a practical standpoint then, the draft adjuster should be set for maximum whenever baffling is to be done. Use up all the available draft possible in the baffling rather than waste the draft by a low setting of the regulator.

Boiler and furnace losses can be divided into jacket losses and stack losses. Since jacket losses are generally useful in keeping the basement warm, they are not generally taken into consideration. Stack losses go on whether the burner is running or not. The loss going up the stack during the running period can be analyzed by $CO_2$ and stack temperature but few servicemen realize that stack losses continue after shutdown, and are a big factor in the seasonal efficiency of the installation.

When the burner stops, air continues to be pulled through the furnace by natural draft, and this air robs heat from the boiler and carries it up the chimney. Where the boiler is kept hot by a domestic water switch, this standby loss is more or less constant. In the case of warm air furnaces, only the stored heat is lost. Any means that reduces the amount of air through the boiler after shutdown is a fuel-saving step.

In an area of zero design temperature and 5,000 degree days, an average burner used through the summer for domestic hot water will run an average of 20 to 25% of the time. This means that a saving of 1% in standby loss is worth 4 to 5% saving in running efficiency, and explains why some burners with no better $CO_2$ and stack temperature than others, will still operate on much less oil over the year.

The weight of a boiler, and the amount of water it contains can affect the amount of oil burned. The boiler which is physically larger will naturally lose more heat from its surface, just as a larger radiator gives off more heat. This heat must be replenished on the next heat call. Perhaps a well-known example will serve to illustrate this point: Take the case of a three-minute egg. Suppose we were to boil two three-minute eggs, one in a large kettle holding considerable water and the other in a small kettle with just enough water to cover the egg. Let us also suppose that these pans have been kept at 180F just waiting for someone to come along and drop in the eggs. It should be obvious that the flame will have to be a little higher to hold the large kettle at 180 degrees than the smaller one, because of the different amounts of surface which are giving off heat to the atmosphere. Now let us put an egg in each pan and turn both flames up to the

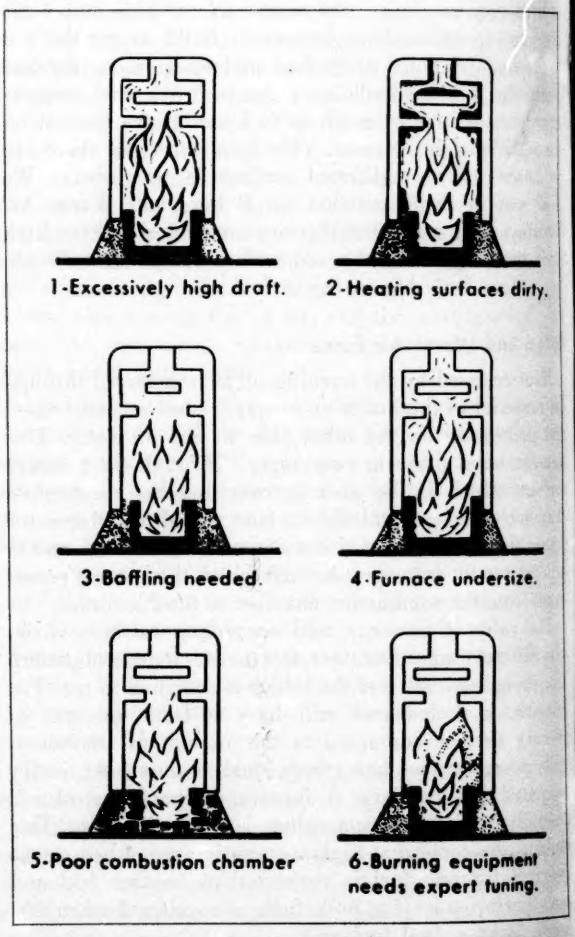



Fig. 19. Stack temperature and the factors that affect it.

same height. Again it should be obvious that the small pan will boil first and have the three-minute egg cooked sooner and with less fuel than the other. See Fig. 18. This situation is exactly comparable to a house that calls for heat in short intervals.

Each of the major components of the furnace or boiler have been discussed in detail with their independent effect on the operation of the equipment. The need for carefully coordinating the combustion chamber with the burner was discussed under the subject of Combustion. The fact that the boiler, too, has a separate and independent efficiency was discussed in the preceding section. Performance of the heating plant as a whole is a function of all of the components and how well they are integrated in the overall design of the heating plant.

### Stack Temperature

Stack temperature was discussed in the Burner section but it must be recognized that if there is not enough absorption or heat transfer surface in the boiler, stack temperature will also be excessive. Furnace or boiler leakage as between the sections, or excess air from the burner all have a major effect on stack temperature. Fig. 19 shows the various faults which may cause excessive stack temperature.

### Carbon Dioxide

The per cent $CO_2$, although primarily a function of the burner and the chamber was also affected to some extent by the boiler. A leaky boiler or furnace will appreciably reduce the $CO_2$. Each component must be designed to work together if high $CO_2$ and low stack temperatures are to be obtained. Several sketches are included in Figure 20 which show various reasons for low $CO_2$.

### Pickup and Standby Loss

Any heating plant has losses during the entire heating season whether the burner is operating or not. The losses are, of course, higher during the running period but may continue during the off cycles. These losses cool down the water (in the case of a boiler), the combustion chamber fire brick, and the steel or cast iron in the boiler. When the thermostat next calls for heat, this entire mass has to be re-heated before the boiler again begins to deliver heat to the conditioned space. This makes for longer running cycles, higher operating costs, and greater stratification, or results in layer-cake heat in the heated area.

Where the burner and combustion chamber and boiler combination provide a high resistance flue gas path, the loss between cycles is minimized and less basement heat goes up the chimney. With a low resistance path, the entire system may be cooled down to room air temperature long before the thermostat calls for heat. These standby losses or extra pickup time are synonymous with high fuel costs.

**TABLE 1—OIL DELIVERED BEFORE HOUSE A WAS CONVERTED**

| Delivery Period | House A | House B | Difference |
|---|---|---|---|
| | Gallons | | |
| 6/12/47 through 10/15/47 | 1,766 | 1,094 | 672 |
| 11/19/47 through 5/ 5/48 | 3,805 | 2,977 | 828 |
| 6/11/48 through 10/13/48 | 1,781 | 1,218 | 563 |
| 11/16/48 through 4/22/49 | 3,462 | 2,902 | 560 |
| 6/15/49 through 9/ 8/49 | 1,242 | 757 | 485 |
| Summer average—3 periods | 1,596 | 1,023 | 573 |
| Winter average—2 periods | 3,637 | 2,940 | 697 |
| Annual average | 5,233 | 3,963 | 1,270 |

**TABLE 2—OIL DELIVERED AFTER HOUSE A WAS CONVERTED**

| Delivery Period | House A | House B | Difference |
|---|---|---|---|
| | Gallons | | |
| 11/ 1/49 through 5/ 2/50* | 3,304 | 3,336 | — 32 |
| 7/11/50 through 10/13/50 | 1,175 | 1,073 | 102 |
| 11/27/50 through 1/ 6/51 | 1,226 | 1,137 | 89 |
| 13 months excluding Dec. 1950 | 4,479 | 4,409 | 70 |

*Colder winter than the others.

### Advantages of Continuous Operation

When an oil burner runs continuously as in a process operation, the seasonal efficiency and the running efficiency are one and the same. However, in normal residential applications, an oil burner may operate from 650 to 3000 hours a year depending upon the accuracy in sizing, and in climatic conditions. The seasonal efficiency may be described as the heat output during the entire heating season divided by the fuel oil input during the same period. In equipment with long off-cycles (oversized equipment) or in mild climates, the seasonal efficiency may be less than one-half of the running efficiency. The careful integration of the design of the components makes it possible for the seasonal efficiency to approach the running efficiency.

General practice is to check $CO_2$ and stack temperature on oil burning equipment after it has run from half an hour to an hour, and is thoroughly heated up. This is a much longer "on" cycle than the equipment normally operates under, and even a reading taken after one hour is certainly no indication of average annual operation. $CO_2$ measured after the unit has been operating various lengths of time from a cold start give varying readings depending on the time elapsed before the reading is taken and on the particular unit being tested. A typical unit which will give 10 per cent $CO_2$ after being allowed to heat up fully, might be less than 3% after two minutes of operation.

The running cycle will vary depending on the type system and the type controls provided. An average cycle for a particular system throughout the year might be seven minutes on and 35 minutes off. A check on $CO_2$ as mentioned will point out clearly the desirability of low mass in a heating plant.

This can be proven most conclusively by a study of actual fuel cost data for identical houses in the same climate or studying the fuel consumption both before and after changing to low mass equipment. The analysis should include a correlation with the degree days for the period when consecutive years are considered.

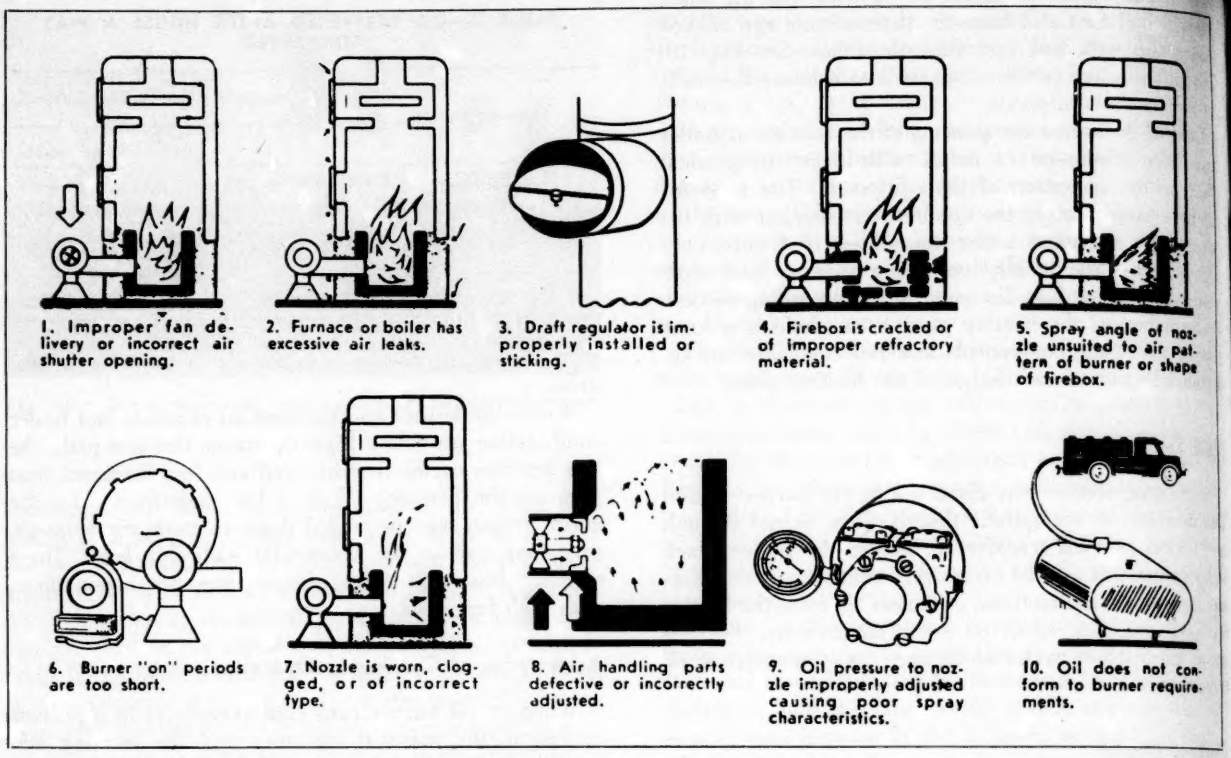

1. Improper fan delivery or incorrect air shutter opening.
2. Furnace or boiler has excessive air leaks.
3. Draft regulator is improperly installed or sticking.
4. Firebox is cracked or of improper refractory material.
5. Spray angle of nozzle unsuited to air pattern of burner or shape of firebox.
6. Burner "on" periods are too short.
7. Nozzle is worn, clogged, or of incorrect type.
8. Air handling parts defective or incorrectly adjusted.
9. Oil pressure to nozzle improperly adjusted causing poor spray characteristics.
10. Oil does not conform to burner requirements.

Fig. 20. Causes of low carbon dioxide in oil burners.

The following is an actual case history of the oil consumption in two indentical small apartments. Apartment *A* was equipped with a high mass boiler, replaced during the period shown. Apartment *B* was equipped with a low mass boiler-burner unit. It is interesting to note that after the relatively new equipment in apartment *A* was replaced with the same type heating equipment used in building *B*, the fuel cost was then practically identical in the two buildings.

The data were furnished by the fuel oil supplier. Since these two buildings were on adjoining lots, oil was supplied to both on the same date in all cases. The periods have been divided to show the higher rate of savings during mild spring weather and the summer months. These data show rather conclusively that the high mass boiler was wasting over 1,200 gal. of oil per year or 32% for the entire season. The summer waste was 56% and the winter waste only 24%.

When the combustion chamber is hot, better vaporization takes place and burning is more efficient. If a unit were to run continuously, naturally considerably less fuel would be burned. This is the reason, as discussed previously, for using low mass fire brick which heats up rapidly. The more rapid the heating, the more rapid the vaporization.

Another advantage of continuous operation is the fact that less leakage normally results and all the heat is being used effectively without the constant loss up the chimney. These items make for higher seasonal efficiency as does the high resistance flue gas path which is the part of both the burner and the boiler. This should indicate clearly the desirability of making accurate heat loss calculations and sizing equipment accordingly. The higher the per cent running time (practically continuous operation on a design day), the higher the seasonal efficiency.

The following example shows how the above factors enter into the picture on efficiency and fuel consumption. Consider for a moment a hotel which provides a very important service to its occupants. A hotel must have a constant, practically unlimited supply of domestic hot water. Many hotels use their space heating boiler for summer service water. The heating boiler was originally selected large enough to provide adequate heating capacity as well as the winter months service water heating requirement. Perhaps 20% of this total boiler capacity is required for domestic water. Yet the boiler operates periodically at full capacity to heat all the boiler water to nearly steaming temperature. This continues throughout the year with long off cycles and the resulting stack and jacket losses.

Assume a hotel with a steam heating system where there are 17,500 sq ft EDR. This radiation requires an allowance of 28.8% for pickup and pipe tax according to the IBR testing and rating code. If the service water represents 20% of the total load and a running efficiency of 60% is assumed, an oil rate of approximately 100 gph is required. A boiler the correct size for 10,000,000 Btu per hr would probably not be available and it is reasonable to expect that in accordance with old practices the boiler might be as much as 100% too big for the application. These factors are neglected in the fuel cost analysis which follows but may tend to actually double the actual fuel in the heating of the service water during the summer months. The boiler installed for this domestic water requirement, as well as the space heating load, weighs about 10 tons, contains about 13,000 gal of water below the steam line and has a combustion chamber weighing about one-half ton. Since the combustion chamber will have about 25 times the temperature rise of the iron or steel and the water, the following analysis can be worked out.

In the analysis only 12½ times the rise is used for the combustion chamber because one-half the rise has been assumed to be useful heat for the heating of the domestic water.

*Water:* lb water × specific heat × (12.5 temp. rise) = Btu per hr
= (13,000 × 8.3) × 1 × (212 − 165) = 5,072,000 Btu per hr

*Iron or Steel:* lb × specific heat × temp. rise
= 20,000 × 0.113 × (212 — 165) = 106,000 Btu per hr

*Combustion Chamber:* lb × specific heat × (12.5 temp. rise) = Btu per hr
= 1,000 × 0.28 × 12.5 (212 − 165) = 165,000 Btu per hr

Total Btu per hr required to heat the mass = 5,343,000

$$\text{Oil consumed} = \frac{\text{Btu} \times \text{number of starts}}{\text{Btu per gal.} \times \text{efficiency}}$$

$$= \frac{5{,}343{,}000 \times 300}{14{,}000 \times 0.60^*} = 19{,}100 \text{ gals per season}$$

This is not the oil used to heat the water but is wasted fuel in bringing the boiler up to temperature. In addition there is other waste fuel. The authors have assumed that 190 hours of operation during the summer season are required to heat the service water exclusive of pick-up time. The boiler will operate about 5% of the time during the summer months and the jacket loss continues whether the unit is running or not. With this condition, jacket loss may be assumed to be about 7% of the boiler rating or 425,000 Btu per hr. Stack loss, assuming seven per cent $CO_2$ and 800F stack temperature is about 3,500,000 Btu per hr, representing the oil consumed during the 190 hours with 60% efficiency. To make up these two items requires 8,900 gal per season. This plus the loss given in the tabulation represents 28,000 gal per season.

The same system could be well heated by a single boiler or two small boilers exclusively for the domestic hot water. Since only 800,000 Btu per hr are required for the full service water requirements, these boilers will operate a much higher percentage of the time so that the running efficiency and the seasonal efficiency would be much the same. Following are computations based on two units with a combined oil rate of 8½ gph over a five months domestic hot water heating season with five starts for each boiler per day or 760 starts per season.

*Water:* (2 × 50) gal × 8.3 lb/gal × (212 − 165) = 39,000 Btu per hr

*Steel:* (2 × 1050) lb × 0.113 × (212 − 165) = 11,200 Btu per hr

*Combustion Chamber:* (2 × 90) lb × 0.28 × 12.5 (212 − 165) = 29,600 Btu per hr

The total Btu per hr required to heat the mass = 79,800

$$\text{Oil consumed in starting} = \frac{79{,}800 \times 760}{140{,}000 \times 0.72}$$

= 605 gal per season

*0.60 = manufacturers rating for efficiency

Even though the smaller boilers will run a great deal longer than the larger units, the fuel waste due only to starting is considered here. It may be assumed that one boiler runs 75% of the time and the other 25% of the time on an average of 30 minutes every hour during the five months season or 1,800 hours. The losses while running again are the jacket losses and the stack losses. A jacket loss of 0.75% while running is reasonable for the small residential type boilers. Since they will run approximately one-half the time, a seasonal jacket loss of 1.5% may be allowed or 13,500 Btu per hr. The stack loss, assuming 10½% $CO_2$ and 650 F stack temperature, gives a stack loss of 21.7%; multiplying this stack loss by the Btu boiler input gives a total stack loss of 260,000 Btu per hr. The oil consumed by stack loss and jacket loss then represents only 4,530 gallons per season or a total of 5,135 when the pickup losses are considered.

This is less than 1/5 of the fuel wasted with the large heating boilers and is due in part to the fact that the boiler was hot a great deal more of the time, making for more economical burning of the fuel in a hot combustion chamber, and in part to the reduction in standby losses. It must be pointed out that part of the fuel that the authors considered to be wasted is actually necessary for the removal of the products of combustion from the burners. It is not used to effectively heat the service water and for this reason may generally be considered to be wasted.

## Summary

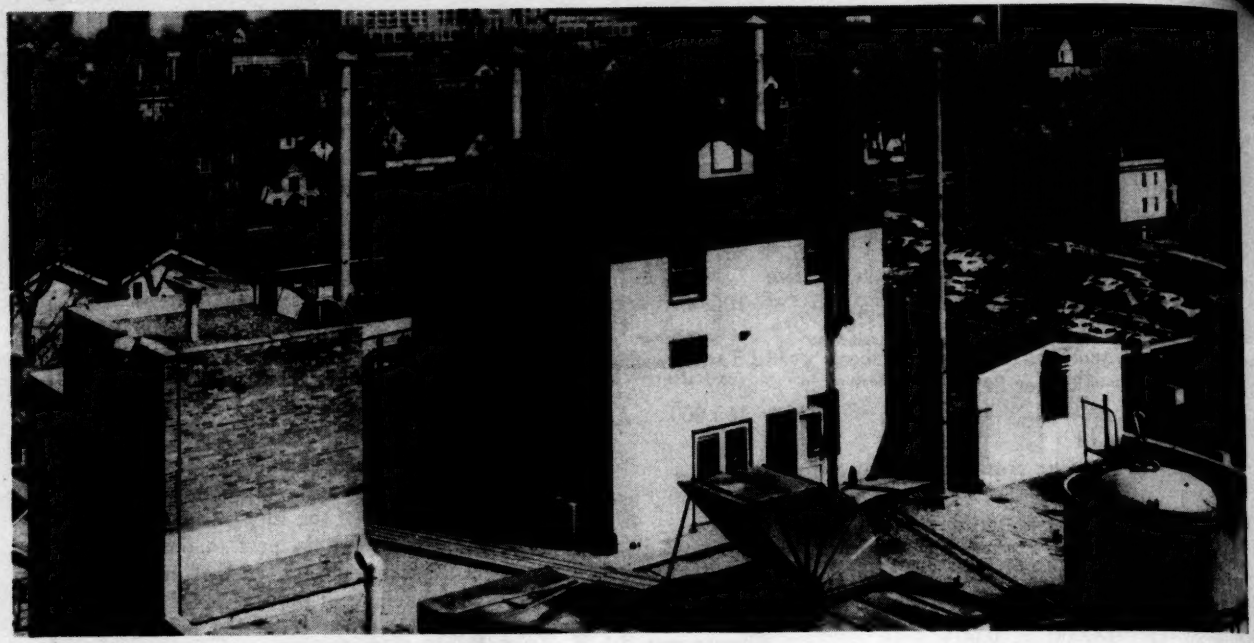
Although each component of the boiler or furnace contributes to the operating costs in its own way, it must also be recognized that the effectiveness of the system in which they are installed has a major bearing on the overall performance. It was not the intent of the authors to go into detail on the systems and their effect on the operating costs. The examples cited above were merely to show the effect of designing a system with proper consideration to all important factors.

Each item must be studied and considered separately if the average home owner or building operator is to have economical, carefree performance over the period of years. Many heating contractors refuse to install conversion burners in obsolete boilers when they know that the operating cost will be prohibitive or that the heat from the burning oil, which is more intense than the coal, may separate the sections of the boiler and require its replacement shortly after installing.

So wherever possible, use an integrated design or use the burner and combustion chamber recommended by the boiler or furnace manufacturer for his particular unit. Size the furnace or boiler to the heat loss of the house (or to the installed radiation on a steam job) and don't over-fire or under-fire the equipment.

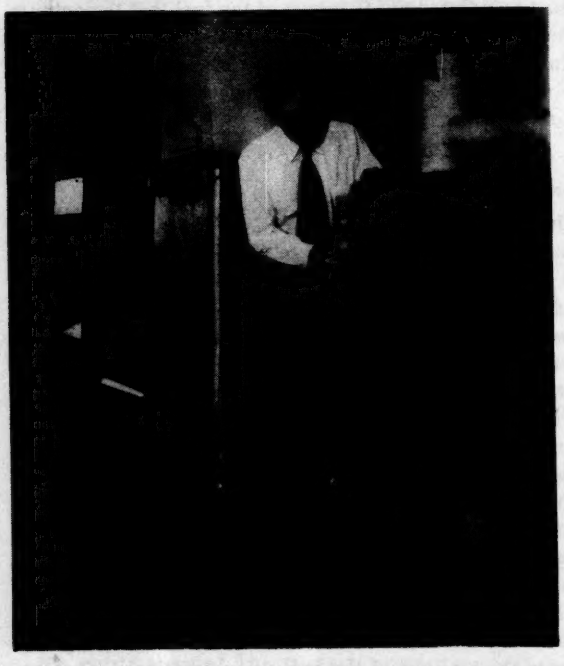
## Credits for Illustrations

Credit is gratefully acknowledged to the following sources for permission to use the illustrations mentioned: Fig. 1, 4 and 18, General Electric Co.; Fig. 5, Petroleum Heat & Power Co.; Fig. 9, Socony-Vacuum Oil Co.; Fig. 10, Silent Glow Oil Burner Corp.; Fig. 3, 6, 7, and 8, Handbook of Oil Burning published by Oil-Heat Institute of America, Inc.; Fig. 19 and 20, Bacharach Industrial Instrument Co.



(Above) Perched on the roof of a six-floor factory building in Minneapolis is this 2-story house where Minneapolis-Honeywell engineers conduct home heating and air conditioning tests.

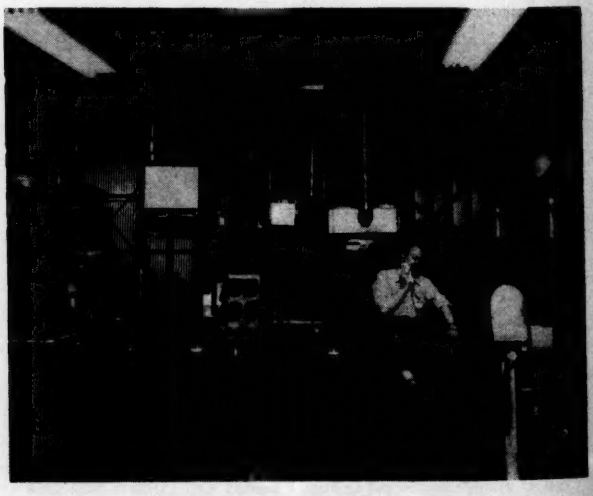
# Most Heated House



(Left) A battery of furnaces and boilers in the basement of the house performs in response to 36 thermostat locations.

(Below, left) The effects of all variations in outside weather are recorded on this panel. There are 140 thermocouple connections to points throughout the house. Brown instruments make records on graph paper.

(Below) This heated heating engineer is making adjustments on one of 16 furnaces used in firing tests on home heating plants.



# Apartment House Cooled and Heated by District Steam

HENRY J. CUSHING
New York Steam Corp., New York, N. Y.

This is an excerpt from a paper, Modern Heating Systems of Large Buildings, presented at the annual meeting of the National District Heating Association, Skytop, Pa.

THE first completely air conditioned multiple apartment house served by the New York Steam Corp. is now being constructed in midtown New York City. This building is a 20-story reinforced concrete structure with a ground area of about 25,000 sq ft and will contain 1,450 rooms or a total of about 350 apartments. There will also be an underground garage which will house about 200 cars.

Refrigeration for air conditioning is supplied by a steam-driven centrifugal compressor of 800 tons capacity and a two-cell cooling tower for this machine is installed on the roof. Hot water for the winter cycle is provided by a heat exchanger interconnected to the chilled water circuit.

### Room Units Installed

More than 1,400 room air conditioning units, each equipped with a fractional horsepower motor are used for both heating and cooling all bedrooms, dining rooms, and living rooms. Since these are all outside rooms, this system may be said to be a peripheral system. Fresh air for each unit is supplied by an aperture in the outside brick wall. Within the unit itself, installed before the piping is connected, is a manually controlled damper, connected by a flexible cable to a switch at the top of the unit. This damper may be opened for summer outside air or closed to winter cold air at the tenant's wish.

Return air from the room itself is mixed with the outside air and the mixture passed through a throw-away filter and blown across the coils by the fan. Return water is discharged from each unit to an upfeed riser and through it to a collecting main in the penthouse ceiling. It then flows back to the pumps in the basement through a single 8-inch downfeed riser in each wing of the building.

Condensation from the coils is collected by a drain pan which runs the length of the unit. Galvanized risers conduct this condensate to slop sinks in the basement.

The tenant may control his room temperature by a three-position fan switch and by regulating the outside air damper. Both of these controls are located under an access door in the top of the unit casing.

Protection against freezing of the unit coils may be obtained by using antifreeze in the circulating water, by maintaining a small flow of hot water in the coils through weep holes in all valves, or by locking the outside-air dampers closed during the extremely cold weather.

Since all piping is enclosed in furred space, it was important to prevent the possible expansion and contraction of the risers from loosening the runouts to the units and causing costly leaks. Connections from the risers to the individual units were therefore made with soft copper tube bent to follow the wall contours and connected by flare adaptors to the risers and units. This tube is insulated and also soundproofed by slipping a thick rubber tube over it before the final flare is made. The use of this copper tube also eliminates all but two joints between the riser and the unit.

The building consists of two entirely separate wings connected by a common lobby and basement. It is served by a single heating and cooling plant in the basement of the north wing. This plant supplies chilled water in summer and hot water in winter by means of supply mains and risers each of which supply one or two units per floor.

### Operation of System

The refrigeration cycle and a medium-pressure heat exchanger are valved so that either one may be used to supply hot or cold water to a 75 horsepower motor-operated pump. A similar pump circulates condenser water for the refrigeration cycle. A third pump is so valved that it may be used as standby to both circulating and condensing water systems.

The refrigeration machinery will at times be operated on a round-the-clock basis and therefore every precaution has been taken to keep noise and vibration to a minimum.

The cubical content of this structure is approximately 4,500 M cu ft. Steam will be supplied through a 6-inch service line. Steam for the turbine will be delivered at 125 psi, for the converter at 40 psi, and for the bathroom and kitchen convectors at 5 psi. For domestic water heating which will be supplied from the basement, steam at 5 psi will be used.

Unfortunately this building is still under construction and it is therefore impossible to discuss any performance results. However, steam consumption for drying out has been well within the estimated values. It is interesting to note that the estimated monthly quantities of steam for air conditioning during the peak summer months are practically the same as the estimate for the two peak heating months. The steam turbine directly connected to the centrifugal compressor has been the work horse of steam air conditioning systems but the absorption machine is another method that is finding application.

# What Would You Do?

## Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

EVERY major industrial plant has a number of centrifugal pumps installed either for building service or process work. Therefore, the current problem which deals with decreased pump capacity of a centrifugal pump should be of general interest.

Each month a problem is presented for discussion that is of interest to the industrial plant engineer. Should you have a question that you would like to see treated in this department or if you have some comments that you would like to present regarding the problems scheduled for future discussion, you are invited to write to the Editor. Such letters are always welcome.

### This Month's Problem

**We have a centrifugal pump which has a rating of 600 gpm. It has been in service for a number of years and the total head by gage measurement has increased six feet from its original 75 ft total head and at the same time the pump capacity has decreased. I suspect that the pump impeller may be at fault. If the impeller is the cause, can you suggest a means for correcting the trouble? If you believe there may be some other reason for this trouble, what can be done?**

### Answers to this Month's Problem

In answering the problem presented by your reader, it is first necessary to assume that:

(1) The interior of the pump is in good condition and that wear has not enlarged the running clearances of the pump over those when the pump was new.

(2) The accuracy of the gage has not changed over a period of years.

Therefore, based on these assumptions, the total dynamic head against which the pump operates consists of the static elevation from the free level of the source of supply to the level of free discharge plus the friction of the system.

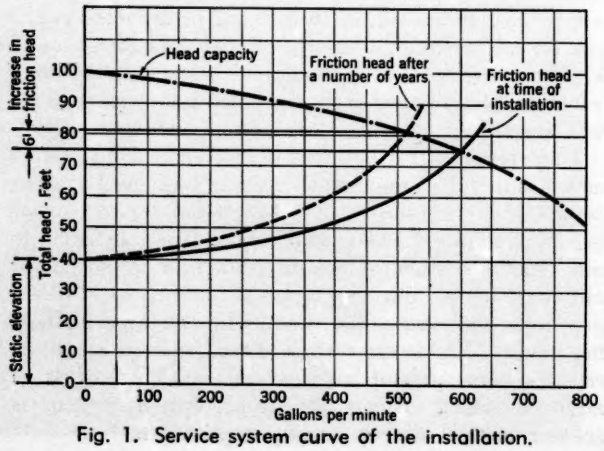



Fig. 1. Service system curve of the installation.

Fig. 1 shows hypothetically the service system curve of the installation. It would be our opinion that over a period of years, the friction in the system has increased by altering the smoothness of the pipe or by reducing the diameter of the pipe by scale. We have noted in this illustration how an increase in the friction in the system would decrease the capacity of the pump and increase the gage reading at the pump discharge.

*Philip J. Olmstead*
*Assistant Chief Engineer,*
*Gould Pumps, Inc.*
*Seneca Falls, N. Y.*

The difficulty experienced by the reader—reduced capacity with an increase in the total head suggests that the friction of his pipe line has probably increased over the years during which the pipe line has been in use. We believe this to be the case since if he had a decrease in pump capacity only, it was probably due to wear within the pump itself, resulting in internal leakage between the wearing rings or an increased clearance between impeller and casing. In such a case, there would have been no increase in the total head which he has noted.

### Problems for Coming Issues

**October Issue**

**A change in the location of some machines brought a number of workers closer to large windows. As a result, last winter, there were many complaints regarding drafts and cold shoulders. At present our large parts assembly room is heated by unit heaters supplied with steam. What type of auxiliary heating would you use and how should it be placed to eliminate such discomfort for employes near these windows?**

**November Issue**

**I have just learned that a lift type check valve installation was connected backwards. There are no marks on the valve to show how to set it properly. Are there any guiding rules for the installation of check valves to insure good operation and maintenance?**

This is readily apparent when you consider that the normal pressure gage has changed. Characteristic performance of a centifugal pump is such that as you increase the amount of liquid the pump discharges, the pressure at which it will discharge is correspondingly reduced. In this case, the head is increased as well as the capacity being reduced, which leads us to believe that the pipe as a result of its length of time in service has a higher coefficient of friction resulting from liming up on the inside of the pipe, or roughening of the inside surface of the pipe, corrosion, etc.

We doubt very much if the impeller could be at fault, although wear in the pump may compound the reduction in capacity that this man is experiencing.

*L. M. Nechine*
*Manager, Production Department,*
*Chicago Pump Co.*

*Chicago, Ill.*

The symptoms point to something causing an increase of resistance in the discharge piping of the pump. If a characteristic curve of the pump is available, the increase in discharge pressure can be checked against the decrease in capacity and if they correspond, a very strong case is established for the foregoing hypothesis. I have known a piping system to slime up and produce just such an effect. Incrustation or other accumulation of solids inside the pipe would produce the same result. The remedy is to clean the pipe.

If the trouble were in the impeller, arising from wear of the sealing rings or damage to the impeller vanes, pump capacity would likely fall off but the discharge pressure would not be likely to rise at the same time.

The following is with a bow to Goulds who published it in their "News" about a year ago. The pump in question would probably be a 5 or 6-inch one in which the diametral clearance in the wearing rings would likely be about .010 to .012 inch. This can be checked with a feeler gage and if it has increased .025 to .030 inch diametral clearance, the impeller rings should be trued in a lathe and new casing rings purchased under size so they can be bored out to restore the original clearance, which can be obtained from the manufacturer when ordering the new casing rings.

The most serious damage to impeller vanes can occur at the inlet due probably to sticks or other obstructions entering the pump. The outlet end of the impeller vanes are comparatively insensitive to damage and can be smoothed up without much effect on the pump capacity or efficiency, if bent.

*H. D. Fisher*
*Consulting Engineer*

*New Haven, Conn.*

All centrifugal pumps manufactured by Worthington or our contemporaries follow certain characteristics. Your reader's pump which had an original rating of 600 gpm against 75 ft total head has now increased 6 ft to a total of 81 ft and this increase in head will automatically reduce the pump capacity.

We don't know what has occurred to increase the total head but all centrifugal pumps operate on a head-capacity curve and as the head increases the capacity decreases and vice versa. Therefore, we would expect a reduced

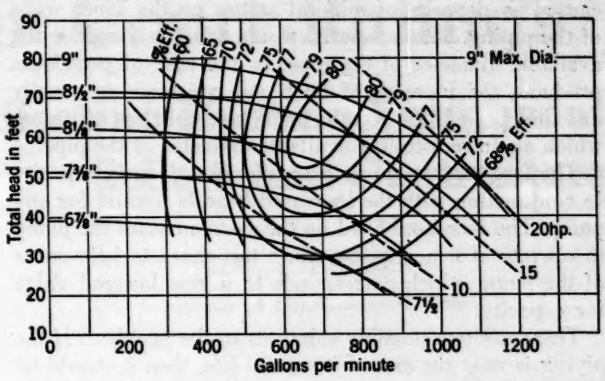



Fig. 2. Pressure and discharge relations.

capacity with an increased head. If the pump is old and the impeller is worn, this condition would be more pronounced.

It is our suggestion that the pump be dismantled and the clearance between the impeller hub and the wearing rings be checked. Also, the reason for the increase in head should be determined. Possibly there is an obstruction in the discharge line, or additional discharge piping has been added to the pump, or additional valves have been installed in the discharge line.

*W. J. Van Vleck,*
*Manager, New York District Office,*
*Worthington Corp.*

*New York, N. Y.*

The trouble described would be experienced by any centrifugal pump user if the pump head increased markedly even though the impeller might be perfectly satisfactory and free from defect. A typical composite head discharge characteristic showing performance of a unit which would discharge 600 gpm at 75 ft is illustrated (Fig. 2). It can be seen from this that as the head increases the discharge decreases. The degree to which this discharge decreases depends upon the flatness or steepness of the characteristic curve. In order to correct this difficulty it is frequently possible to put in a larger size impeller. This should be taken up with the manufacturer of the pump. Much more consideration must be taken into account here but this can easily be determined with the pump manufacturer by checking with the serial number of the unit furnished.

Although extreme wear on the impeller or wear rings might tend to exaggerate the condition described, or a decrease in pump capacity, at the same time we must recognize that even with a perfectly new unit head the pump discharge frequently decreases markedly with increase in head. This is true of any centrifugal pump by its very nature.

*Harold Franz*
*Peerless Pump Division,*
*Food Machinery and Chemical Corp.*

*New York, N. Y.*

The total head of a pumping system may increase over a period of years due to an increase in the frictional resistance of the piping system. The question presented does not indicate the type of liquid conveyed but in the case of water the increased frictional resistance may be

caused by deposits of mineral matter on the inner walls of the piping. These deposits would effectively reduce the available diameter of the pipe. In the case of petroleum products, the increase of frictional resistance is usually due to deposits of sludge in the horizontal runs of piping which again reduces the available diameter of the pipe.

The fact that the pump has suffered a drop in capacity in conjunction with the increased head is normal for any pump. The increased head on the system causes the pump to operate at a new point along the characteristic curve of the pump which corresponds to a new lowered value for capacity.

There are two possible solutions to the problem. If the piping is near the end of its useful life, then it should be replaced and the resultant decrease in resistance will bring the pump back to its rated operating capacity. On the other hand, it might be more feasible economically to leave the piping system alone and to replace the impeller of the pump with one of larger diameter. A larger impeller could be chosen that would deliver the rated capacity at the new operating head.

In the latter case, it would be good practice to select an impeller that could deliver the quantity desired at more than the present actual head and the difference in head compensated for by the introduction of an orifice or other restricting device. In this manner, future increases in head could be adjusted for rather simply. The brake horsepower should be checked to be sure it does not exceed the available horsepower of the motor.

*Norman Singer*
*Mechanical Designer,*
*Jaros, Baum & Bolles*
*Consulting Engineers*
*New York, N. Y.*

## New Alcoa Building, Pittsburgh, Employs Radiant Ceiling

A feature of the new Aluminum Company of America's 30-story office building in Pittsburgh's Golden Trinagle, is a ceiling of unusual design that combines radiant heating and cooling with acoustical control.

The ceiling is of 0.040 inch perforated aluminum sheet panels, suspended below grids of ½ inch aluminum tubing installed on one-foot centers. The grids are prefabricated in sections approximately 6x12 ft. Hot or cold water is circulated through the grids to provide radiant heating in cold weather and radiant cooling in warm weather. The grids are covered by ¾ inch thick fiberglass blankets to absorb unwanted room sounds.

The panel and tube system is designed to provide complete heating of the building and 50% of the summertime cooling, the remainder of cooling is supplied by air conditioning units which also take care of all dehumidification.

This type of ceiling covers 250,000 sq ft and is said to be a factor in saving about 15,000 sq ft of rentable floor space as all heating and cooling units are concealed in the ceiling. The installation is said to be one of the largest of its kind. The system is said to provide uniform tempering of air throughout the room.

Steam, purchased from the Allegheny County Steam Heating Company, with the inlet located in the subbasement of the building, supplies a heat exchanger to provide hot water.

Water for radiant and air cooling will be cooled by two 625-ton centrifugal compressors located in the basement. A cooling tower is used for condensing.

For flexibility of heating and cooling control, thermostats will be located in a typical room for each zone on each floor. Corner and executive offices have additional individual controls to provide for special conditions. Thus panel output can be varied by modification of the water temperature flowing through the grids.

Architects who designed the Alcoa Building were Harrison & Abramovitz, New York, with Mitchell & Ritchey and Altenhof & Bown, Pittsburgh, as associate architects. George A. Fuller Co., New York, were general contractors and Jaros, Baum & Bolles, New York, were the mechanical consulting engineers.

This Burgess-Manning ceiling is a development of a system invented by Gunnar Frenger of Oslo, Norway. His ceiling is widely used in Europe, the latest installation being 100,000 sq ft in the new United Nations building in Paris. United States rights were secured by Burgess-Manning several years ago and several modifications and developments have been added.

View of ceiling grids and air conditioning ducts installed in the Alcoa building, Pittsburgh, Pa.

# Important Higher Court Rulings

## Affecting Heating Equipment Sellers and Contractors

**How the higher courts have ruled in a number of court cases of interest to those engaged in the selling and installation of heating equipment.**

LEO T. PARKER

Attorney at Law, Cincinnati, Ohio

A READER, in an interesting letter to me, wrote in part:

"For many years I have been a constant reader of your legal discussions and articles in HEATING AND VENTILATING. I have a scrap book in which I have classified your cited higher court decisions and when I am confronted with a legal problem I simply refer to my book and read the law so I will know what to do to avoid liability. In several instances I believe I saved myself much money in law suits by referring to my book and avoiding legal pitfalls. I have a question now. Can a property owner compel a heating contractor to fulfill the terms of his contract?"

According to late higher court decision, the answer is no.

### Must Sue for Damages

Recently a higher court held that a property owner cannot compel a heating contractor to complete a job according to the terms of the contract signed by the contractor. The property owner's only remedy is suing the contractor for damages.

For example, in London Bucket and Heating Co., Inc., v. Stewart, 237 S. W. (2d) 509, a heating contractor signed a contract for installation of a heating system for a large motel. The contract contained a clause that the contractor guaranteed to heat the building to 75F in winter, and to install the heating plant in a complete, skilled and workmanlike manner.

The property owner sued the contractor and testified that the latter performed unskilled workmanship, never finished the system which was of such size, type and inferior quality of materials that it does not perform the purpose contemplated.

The property owner asked the court to compel the contractor to complete the job and to specifically perform the terms of the contract and furnish the type of furnace provided in the contract and "all the things necessary to properly heat said building and rooms."

The lower court rendered a favorable verdict for the property owner. The higher court reversed the verdict, holding that the only remedy for the property owner was a suit against the contractor for damages. The court said:

"In the present case, the lower court's decree was in effect to direct a building contractor to go back, correct defective work and complete its job. It is the general rule that contracts for building construction will not be specifically enforced because ordinarily damages are an adequate remedy and, in part, because of the incapacity of the court to superintend the performance."

### When Lien Notice is Valid

Considerable discussion has arisen from time to time over the legal question: "How much in detail must be a notice to a property owner that a heating contractor intends to file a mechanic's lien?"

According to a recent higher court the answer is: The lien is valid if the heating contractor includes in his notice to the property owner sufficient data to enable the property owner to avoid double payments.

For example, in Mullool Heating and Plumbing Co. v. Short, 74 Atl. (2d) 136, it was shown that a property owner contracted with a general contractor to construct a building. The general contractor made a contract with a heating contractor to install the plumbing and heating systems in that building. The heating contractor made the installation in accordance with the contract. The property owner defaulted in making payment to the general contractor and the heating contractor served notice on the property owner of a claim for a mechanic's lien. This notice merely stated that the heating contractor was filing a claim for a specific sum of money due for labor and materials for the installation of the heating and plumbing equipment in the building the general contractor had constructed.

Although the property owner argued that the mechanic's lien was void because the heating contractor had not included all details as to labor and materials in the notice, the higher court held the mechanic's lien valid, saying:

"The purpose of the required notice is to inform the owner of the demand and the nature thereof in order that he may protect himself. . . Defendant Short (property owner) was notified of the cost of the materials and labor for which payment had not been made. . . This was sufficient to enable him to determine how much he should withhold from the general contractor Le-Donne in order to avoid double payments."

### No Liability

According to a late higher court decision, if a property owner continues for a long period of time to use a defective heating system, such property owner forfeits his right to sue the contractor.

For example, in Coovert v. Ingwersen, 226 Pac. (2d) 187, a contractor filed suit to foreclose a lien upon a dwelling house to secure payment for a heating system in the home for the sum of $770, plus sales tax of $23.10,

that is, in the aggregate, $793.10. The heating system was a gravity hot air system which furnished inadequate heat.

The property owner filed a counter suit for damages against the contractor because the heating system forced through the house a deposit of oil, dust, and smut upon the walls, windows, curtains, and tapestries, and that, for those reasons he had refused to pay any part of the contract price and demanded that the contractor take the furnace out and return the furnace which he took out of the house.

The higher court refused to allow the property owner any damages, saying:

"Where a party desires to rescind upon the ground of mistake or fraud, he must, upon the discovery of the facts, at once announce his purpose and adhere to it. If he remains silent, and continues to treat the property as his own, he will be held to have waived the objection, and will be conclusively bound by the contract, as if the mistake or fraud had not occurred."

For comparison see Loveland v. Aymett's Arcade, Inc., 121 Conn. 231. Here a property owner sued a contractor for damages claiming that, although the contractor had given no guarantee on the installed heating system, yet he should be held liable for breach of an implied guarantee to install a system reasonably satisfactory. The higher court held that there was an implied warranty that the contractor must install this furnace with the usual skill accorded to such matters, and the court said:

"The plaintiff's (contractor's) agreement to install the equipment carried with it an implied obligation to use proper care and skill in so doing."

In other words, this court held that there may be an implied guarantee of the quality of the heating system, and there can be an implied guarantee of the quality of workmanship done by the contractor when installing the heating system. This is so whether or not the contractor gives the property owner a verbal or written guarantee.

### Need Not Fence Excavation

Recently a higher court was asked to decide this question: "Is a contractor legally obligated to fence or barricade a hole to protect adventurous and trespassing boys?"

This court held in the negative.

For example, in Holifield v. Wigdor Heating Co., 235 S. W. (2d) 564, the testimony showed facts as follows: A property owner purchased from the Wigdor Heating Co. an oil furnace to be installed in his residence. The Wigdor Heating Co. was to install the oil heating system, including a 500 gal. underground oil tank which was to be located adjacent to the residence. After the furnace and two small oil tanks were installed, a hole was dug for the large tank. There was a good deal of rainfall after the hole was dug and soon the hole was brimful of water.

One day a small boy entered the water-filled excavation and was drowned.

The parents of the boy sued the Wigdor Heating Co. for heavy damages. In holding the Wigdor Heating Co. not liable, the higher court said:

"If we assume that the deceased child was attracted to the property by the bright and shiny tanks, the water-filled hole and the fresh earth around the hole, the evidence fails to show that such conditions were inherently dangerous and thus constituted a dangerous and attractive nuisance. While the hole was dug five days before the accident, completion of the work was delayed because of rainy weather. At most, the failure to place a fence or barricade around the hole 'was no more than mere casual negligence'."

### Must Refile Same Notice

Recently a higher court held that if a heating contractor furnishes labor and materials under one contract on two different properties situated in different counties, he must file the mechanic's lien in both counties.

For example, in Drinkard v. Hall Heating Co., 47 So. (2d) 213, the Hall Heating Co. took a contract to furnish and install heating and plumbing for a property owner in two properties, situated in two different counties. The contract price was not paid and the heating contractor filed two identical mechanic's liens in both counties.

The higher court held that since a lien was filed in each county, the heating company had valid liens to secure payment of the contract price. The court said:

"We hold that appellee (Hall Heating Co.) perfected two liens, one on the property located in the City of Cullman and the other on the property located in the City of Hartselle."

### Subcontractor Breached Contract

Some argument has arisen from time to time over this legal question: "If a subcontractor breaches his contract with a general contractor, how much money can the subcontractor recover for work and materials furnished up to the date he breached his contract?"

According to a recent higher court decision, the subcontractor may receive payment for the *actual value* of labor, plus materials which he furnished *before* the breach occurred.

For example, in Nickel v. Pollia, 179 Fed. (2d) 160, it was shown that a subcontractor entered into a subcontract with a general contractor for the installation of heating fixtures for $89,244. The subcontract provided that the general contractor would make partial payments as the work progressed. Later the subcontract was terminated by the general contractor because of the subcontractor's breach.

The higher court held that the subcontractor was entitled to recover only the "reasonable value" of the services rendered and for the material furnished before he breached his contract. The court said:

"Having breached his contract, Pollia (subcontractor) could recover only the reasonable value of the services rendered and of the material furnished."

### Come into Court with "Cleans Hands"

There is an old adage that one who files a suit must come into court with "clean hands." Recently a higher court held that although a heating contractor breaches his contract, the property owner cannot rescind the contract unless he offers to give the contractor possession of the already installed heating equipment, irrespective of its faults.

For illustration, in F. M. Cooley Heating Equipment Co. v. Stoeffler, 92 N. E. (2d) 926, the testimony showed

facts as follows: A heating contractor made a contract with a property owner to install a heating plant comprising an American Quick Heat oil burning furnace, model A-75-UB; two large oil tanks and several warm air and cold air runs. The contract contained a clause that any extras not mentioned in the contract would be charged to the property owner at reasonable prices. The heating contractor guaranteed that the plant would heat the residence to a temperature of 72F in zero weather. After this contract was signed, the heating contractor learned that the model A-75-UB furnace could not be supplied by the manufacturer and the contractor installed a model H-55-D as a substitute. The property owner refused to pay the contract price claiming that the substituted furnace "is grossly inadequate" and will not heat his residence as guaranteed by the heating contractor.

The property owner sued the heating contractor for damages and rescission of the contract. However, the property owner did not offer to permit the heating contractor to take possession of the already installed substituted furnace from the residence. Hence the higher court held that he could not rescind the contract, and said:

"The furnace was inadequate to meet the appellant's (contractor's) heat guaranty but it was new when installed and the product of a reputable manufacturer. There is no evidence that it was defective or that it failed for any other reason than that it was too small for the task it was sold to perform. The common experience of mankind compels us to conclude that it not only had value to the appellant (contractor), who is a dealer in heating equipment, but also it had intrinsic value to anyone."

### When Contract is Valid

According to a recent higher court, parties who intended to be obligated by a contract are fully liable and responsible, irrespective of discrepancies in signatures.

For example, in Willis Theatre v. Kelly, 26 So. (2d) 232, a contractor sued a theatre owner for $999 for installations made in the building. The contract was not signed in the full name by the theatre owner, but was signed by his initials.

The higher court held the theatre owner liable for payment, since the evidence showed that he intended to be obligated when he initialed the contract.

### Damages Must be Adequate

Modern higher courts consistently hold that a property owner injured by breach of a contract is entitled to compensation for his losses which are the natural consequence and proximate result of the breach. The purpose of such compensation is to place the property owner in as good a position as that in which full performance of the contract would have placed him. However, he is not entitled because of a breach to be put in a better position than he would have been had the contract been fully performed.

For example, in Henry J. Robb, Inc. v. Urdahl, 78 Atl. (2d) 387, it was shown consulting engineers contracting to furnish plans for a heating system which would heat a building to 70F negligently failed to furnish the proper plans and later supplied supplemental plans which provided for a system that would heat the building to 70 degrees any ordinarily cold day.

In subsequent litigation the higher court held that since the cost of installation of the system would have been $183.30 less if the original plans had been correctly drawn, the engineers are liable to the property owner for $183.30 damages. The court said:

"The court found that had the plans been correctly drawn originally, the cost of installation would have been $183.30 less than the total cost of the two jobs. This difference was due to an increase in costs of material and labor between the dates of the original and the final installations. For breach of a contract, the injured party is entitled to be compensated for losses which are the natural consequence and proximate result of the breach."

### Manufacturer Liable for Profits

Modern higher courts consistently hold that if a manufacturer breaches an "exclusive agency" contract with the seller of heating equipment, the manufacturer is liable for *all* profits the dealer would have earned had the contract not been cancelled.

For example, in Howland Co. v. Irona Co., 213 Pac. (2d) 177, it was shown that a manufacturer of automatic coal burners and automatic oil burners signed a contract by the terms of which a retail dealer was appointed an exclusive dealer in the county and with the exclusive right to sell the manufacturer's units. The retail dealer hired a salesman, and as fast as oil burners were supplied by the manufacturer the dealer sold and installed them. Also, the dealer received many deposits from customers for future installations and paid the salesman's earned commissions on these orders.

Apparently without good reason, the manufacturer ceased to fill the dealer's orders. Due to the fact that the manufacturer refused to fill the orders the dealer was compelled to cancel many orders and refund deposits to customers.

In subsequent litigation the lower court awarded the heating dealer $10,284.90 lost profits, plus $26,162 damages.

The higher court agreed that a manufacturer is liable for all normal damages sustained by a retail heating dealer whose valid exclusive dealership is violated or cancelled by the manufacturer.

### Contractor Not Negligent

Recently a higher court was asked to decide this question: "What testimony must a heating contractor give to avoid damage liability for injuries caused purchasers of heating appliances?"

The answer to this question is: The contractor must have testimony that will convince a jury that the heating appliance was not defective when delivered and the contractor was not negligent.

For example, in Sanders v. Reed Co., 54 S. E. (2d) 482, the testimony showed facts as follows: A woman wanted a stove for heating water, and she went to a heating contractor. The contractor did not tell her, so she testified, that the stove she purchased was a stove for heating water, but told her it was an ordinary plain heater. She purchased the stove and it was delivered to

her home by the contractor. The woman, herself, installed the stove and connected the pipe to the flue. The woman started a fire in the heater, and soon after the fire began to get hot the stove exploded, because the water jacket was tightly plugged. The stove was broken into numerous pieces, and flying metal hit her causing serious injuries. The testimony showed that the stove was a laundry heater, with a water jacket, and not a common heater.

The jury decided that the injured woman could not recover damages from the contractor because at the time the stove was delivered to her, it was not plugged to prevent escape of water and steam. The higher court approved the verdict, saying:

"The plaintiff's (woman's) case was predicated entirely on the theory that the water jacket was plugged at the time it was sold and delivered to her; and that when a fire was started in the stove steam was generated in the jacket, causing the stove to explode. These questions of fact were for the jury to determine from a consideration of all the evidence, and they were resolved in favor of the defendant (seller)."

Hence, this heating contractor won a favorable verdict because he convinced the jury that the stove contained no plugs when it was delivered to the purchaser, and the contractor was not negligent.

### Must Prove Negligence

According to a recent higher court, one injured in a building cannot recover damages from the owner of the building unless he proves conclusively that the injury itself resulted from negligence of the building owner or his employes or officials.

For example, in Lerman v. Unique, 85 N. E. (2d) 863, an employe sued the Unique Co. for damages. The employe proved that while he was doing work in the building, an oil burner exploded causing serious injuries.

The lower court held Unique Co. liable in heavy damages, but the higher court reversed the verdict because the employe failed to prove that negligence of the employes or officials of the company was the proximate cause of his injuries.

Although the employee proved that the company's employes were negligent in keeping the oil burner in clean and good condition, yet he failed to prove that negligence of the employes caused his injury and therefore he was not entitled to damages.

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## Some Recent Developments in Housing Research

The most significant recent development in housing research, according to Joseph H. Orendorff of the Division of Housing Research, Housing and Home Finance Agency, in a talk before the annual convention of the National Association of Home Builders, is the expansion of investigations, from a narrow concentration on physical characteristics of materials and performance of structures and equipment, to include the comfort, convenience and satisfaction of the family that occupies the dwelling.

Recognition of the need for an integrated approach and the absence within the home building industry of facilities and funds to initiate such a program was given in the Housing Act of 1949 which authorized a Division of Housing Research within the Housing and Home Finance Agency.

Many recent research results were a culmination of work which, suspended during World War II, was resumed with funds made available under the Veterans Emergency Housing Program in 1946 and 1947, and continued under the limited program of research in building codes and modular coordination authorized by the Housing Act of 1948. In spite of the interrupted and sporadic nature of Government activities in research, a degree of continuity by experienced personnel has been maintained with constant assistance given to the home-building industry.

An outstanding example is that of plumbing research. Work started at the National Bureau of Standards, Hydraulic Laboratory, by Dr. R. B. Hunter for the Central Housing Committee, was resumed by the National Housing Agency and continued by the HHFA through the present going contracts. The results of these investigations have been utilized in the National Plumbing Code, published in June 1951 and represent a joint effort of the Department of Commerce and the Housing and Home Finance Agency with the advice of the Plumbing Code Coordinating Committee.

Another example of a continuing project sponsored by the division that has played a significant and important role is the test house constructed at the National Bureau of Standards within an air conditioned laboratory. Almost every conceivable method of heating, from the conventional to the most radical has been tried and tested in this test structure. Several favorite schemes of the heating industry's more imaginative minds have either been discarded or evolved as practical systems as a result of this work.

The Division of Housing Research seeks to encourage and stimulate needed research in those areas where essential data are lacking, and, where problems require facilities that are available to government alone or where methods of investigation have not been developed, it sponsors or undertakes research on its own initiative after seeking the advice of industry representatives appointed to advisory committees. Having no laboratory facilities of its own, it uses the facilities of other Government agencies or contracts with colleges, universities and non-profit research organizations having the required facilities and personnel.

# Theory vs. Practice in

# Radiant Heating

T. NAPIER ADLAM

Vice-President, Sarco Manufacturing Co., and Technical Director, Sarcotherm Controls, Inc.

**Part 6. This is the concluding article of a series that started in the April, 1952 issue. Attention is directed to the importance of suitable floor temperatures and the exercise of care in system design.**

A suggestion one must be guarded against, and one which evidenty emanates from those who desire to claim higher ratings from a heated floor, is to raise its temperature. When we contemplate obtaining additional heat by using higher surface temperatures for the floor, we are really on dangerous ground, and I am afraid that those who speak in favor of higher floor temperatures have not yet realized the biological effect this has on the human body and the consequent greater need of more moderate floor temperatures. It is conceded by physiologists and laymen alike, that a floor temperature which may be considered satisfactory in the summer, will have quite a different effect on the human body in winter.

More complaints have reached me, and more people have sought my advice concerning high floor temperatures; during the last three or four years, than I have known in the 30 years or more I have been associated with radiant heating. Only recently a case was brought to my attention where, in an industrial plant, the workmen were compelled during the winter to use boards and other insulating material on which to stand because the heated floors were too hot for comfort. Many similar complaints reach me from home owners asking if there is any remedy for hot floors and cold rooms. Therefore, we should not attempt to increase the floor temperature to a point where the biological reaction is detrimental to health and comfort. Then again, there is the temperature effect on carpets, rugs, asphalt, tiles and many other kinds of floor covering.

For America, I established many years ago a maximum floor surface temperature of 85F for extreme weather conditions, and while slightly lower surface temperatures are advocated by some physiologists, I find that if a maximum of 85F is used for all radiant heat floor surfaces, the average for the winter is usually between 75F and 79F, depending on the locality.

### Temperature Lowered for Factory Floors

For industrial plants where employes remain standing for long periods, I prefer to reduce the floor temperature 2 or 3F, and supplement the heat with larger unit heaters or other suitable methods of convected heat, because I have found that when the floor temperature is high, the stamina is lessened and the output reduced. At our factory in Bethlehem, Pa., we have several large workshops where floor heating is provided, supplemented with automatically controlled unit heaters. On occasions, under different weather conditions, I cut out some or all of the unit heaters and allow the floor temperature to go a little higher than normal for the purpose of discovering what effect this condition has on the workmen. It never fails to bring, first, a slowing up of movement with a lower output, and then general complaints. The same general result occurs when I try similar tests in the offices where we have floor heat supplemented with ceiling coils. In this case I cut out the ceiling coils and raise the floor temperature.

In large plants, and places where positive ventilation is essential, as in garages, bus terminals, and the like, the air inlets to the unit heaters are usually cross connected to the outside and are fitted with movable baffles so that a portion of the air passing over the heated surface may be drawn from the outside, and in this way ensure a positive ventilating system. Extra heat for ventilation should not be assumed to come from any heated panels, because this leads to a condition where the MRT is too high which will also reduce the vitality of the employes and lead to a lower output per man-hour.

### Heat Emission

In the hope that it will prove useful in analyzing this problem of heat emission from a heated floor, I have shown in Fig. 21 (see Part 5, H & V, Aug., 1952) a set of curves plotted from temperatures recorded from tests taken in a large room with a concrete floor of ordinary finish with electric conductors embedded 3 inches below the floor surface and on 4.5-inch centers. This method of heating was selected for this particular test in order to obtain a fairly even surface temperature over the whole of the area, and at the same time, to provide easy means of measuring the heat load at any instant. While these tests were run continuously, over a period of many months, the temperatures shown were in all instances recorded on selected nights after conditions had been stabilized for several hours. The air temperatures and the MRT of unheated surfaces were controlled without creating more than 50 fpm air movement over the floor, usually less.

I have always preferred to make many of my important heating tests in a room exposed to the natural outside conditions, and to select nights when the outside conditions are fairly stable and conducive to reliable results, rather than to make these tests in a room situated within an enclosure with an artificial surrounding atmosphere. For some tests the latter method may be very helpful and sufficiently accurate for general purposes but, generally speaking, many of the natural influences which affect heat losses and heat gains to a building are missing and may seriously affect the final conclusions arrived at.

The temperatures given are the actual readings of a

globe thermometer placed 4 ft above the floor, and while several different types of thermometers were employed at selected places during the tests, the recordings only of the globe thermometers 4 ft above the floor apply to this chart, except those giving the actual air temperatures and the MRT of the unheated surface at the time of each recording. It will be noted that while the surface temperature of the floor was maintained at predetermined temperatures, the MRT of the unheated surfaces and the air temperature of the room were changed according to each curve.

The figures enclosed within the circles indicate the average temperature of the air in the room during each particular test registered by bare thermometers, and the figures within the squares represent the average surface temperature of the unheated surfaces only, and not the MRT of the total surfaces. The average surface temperatures of the unheated surfaces were recorded by taking surface temperatures at regular intervals over these areas.

The purpose of plotting the figures in this way is to show that under certain conditions of MRT and air temperature, the emission from a heated panel can be quite high, although most of these conditions are outside the zone of human comfort. It is not intended that this chart be used for obtaining the total emission from a heated floor panel, when making calculations for rooms, because this information can be obtained more easily from Radiant Heating, pages 353 and 371 in the first and second edition, respectively. It will, however, indicate what may be expected from a floor heated to 85F, and point *X* on Curve C, Fig. 21 (Part 5, H & V, August, 1952) represents what I consider the best conditions for human comfort. This point shows an emission from the floor of 38 Btu per hr per sq ft of floor surface.

### Heat Output from Floors

From these results, and the results of numerous other tests which I have taken, it would, in my opinion, be very unwise where comfort is aimed for and where people have to keep their feet on the floor for long periods at a time, to assume a total output greater than 38 to 40 Btu per sq ft of floor area.

I am quite aware that in recommending the use of these figures for heat emission, it raises the problem of having too much heat to meet the actual heat losses from rooms where the calculations are based on the usual overall coefficients used for other systems. To overcome this problem, I know some professional engineers who specify water temperatures of 140F for floor coils, knowing full well from previous experience that water temperatures in the neighborhood of 100 to 105F will be quite ample to give a floor surface temperature sufficient to supply all the heat they need, but how much they do not know. These engineers will also specify such high water temperatures as 160F to 180F for ceiling coils, knowing that such high water temperatures may cause trouble with the plaster and that a temperature of 120F to 130F will give all the heat required. In the same manner, one often finds that the specified temperature of the circulating water for hot water radiators and convectors is elevated above the actual requirements and for the same reasons, although for these systems the difference may not be as great. This is done, I am told, because they are satisfied that the heat losses calculated when using the usual methods will not be required, and by specifying a higher temperature for the water than is necessary, they hope heating contractors will provide less pipe for radiant panels and smaller radiators, etc., to compensate for the incorrect values of *U*.

However, while waiting for more correct values which can be applied to *U*, I do not believe we should confuse the issue by assuming we are getting more heat from a floor or ceiling than is possible, just to obtain a fictitious balance; neither should we make the surfaces too hot for health and safety to reduce the cost of the installation, even though by doing so the air temperature is sufficiently high, because after all, a good cast iron radiator with hot water or a good convector job, may well be more desirable than a bad radiant heat job.

It is unfortunate that the high values we use for *U* seem to confuse the whole issue. However, until we are able to obtain more reliable figures which we can use on both sides of the equation, it seems to me that it is more confusing to assume that something is correct which we believe to be incorrect, and then use another set of incorrect figures to obtain a balance. If we feel convinced that the exposure factors we use are too high, and we have some fairly reliable data on panels by which we can prove that heated panels with certain surface temperatures and under a given set of conditions, will give off a definite number of Btu's. It seems logical to suggest that we use those figures which we feel convinced are correct, and for the time being, suggest a lowering of the other values, either by a percentage, or provide a revised list of values which everyone may use in the interim.

### Suitable Floor Temperature

While it is true that the total heat emission from the surface of a floor will vary according to the difference between its average surface temperature and the surrounding air and the unheated surface temperature, it also seems to be true that the total emission will vary according to the maximum and minimum temperatures upon which the average surface temperature is computed. Consequently, it does not seem possible to give one definite figure which will hold good in all cases. For instance, the total heat emission from a floor which may be assumed to have an average surface temperature of 85F because the surface temperature is 100F above the pipes and 70F between the pipes, is not likely to be the same as from a floor which may also appear to have an average surface temperature of 85F because the surface temperature is 87F above the pipes and 83F between the pipes. However, when allowances are made for all possible contingencies, it seems very evident that no such high figure as 70 Btu per hr per sq ft of floor is even remotely possible. For greater accuracy, I prefer to use the separate charts for radiation and convection a shown in Fig. 246 and 247 of Radiant Heating, and use smaller values for *U* which I have found to give very good results. With the general knowledge of heating at our disposal, and data which we already have concerning the output from heated panels, I think if we do reduce these values, we can obtain some very close approximations.

Radiant heat is not the only method of heating to cause us trouble, because we can have many perplexing problems when dealing with cast iron radiators and convectors, whether we use steam or hot water. While many of the values usually used for *U* appear to be much too high for

every method of heating, I believe the actual output from radiators and convectors rarely lives up to the expected ratings as presented to us. One of the reasons is that, like the many compromises which a contractor may have to make when constructing radiant heat panels, he has to make compromises when installing radiators or convectors. A contractor may have to install these units entirely different to the way recommended by the maker, and in consequence they are less efficient. However, there is a considerable difference between radiant heating and systems using radiators and convectors, when we consider the responsibility.

In using the latter systems, we usually console ourselves with the thought that we can raise or lower the steam pressure and use orifice plates to regulate the flow of steam to each steam heated radiator or convestor, and in somewhat the same manner, with hot water as the medium, we can raise or lower the temperature of the circulating water over a fairly wide range and use balancing fittings to regulate the flow of hot water to each unit. With warm air inlets and some convector units we have the advantage of being able to adjust the baffles to accomplish a very good degree of regulation, and if the worst happens and we have insufficient heat, it is generally possible to replace the unit easily with one having a larger capacity.

### Care Required in Design

With radiant heating, however, while it is possible to use balancing fittings and controls to tone down the heat if we have too much, our temperature limits are invariably closer because of constructional or biological factors. When we have insufficient heat, or no heat due to bad workmanship, or incorrect design, any necessary changes will mean a very costly undertaking. My sincere advice to all engineers and contractors is to be safe and take notice of the growing reaction to hot floors and inefficient installation. Many people in America, including some architects and engineers, are still prone to shy away from radiant heating simply because too many inefficient installations have confused the outlook for this particular type of heating.

Before leaving this phase of my commentary, I would like to remind readers that while we may be able to get more heat from a surface that is fully exposed, and a little more heat when air is moving over its surface, a fairly large percentage of the floor area is often covered with furniture, desks and benches. On the other hand, if we are considering a building similar to a church, and the pews or other fixtures are built into the floors so that the conduction of heat from the floor into the pew construction can be of any appreciable extent, then the extra heat given off from the warmer surface of the pews may be inadvertently assumed to be heat given off from the floor. However, since the conduction of heat is problematical, and the reduction of effective floor surface is generally very uncertain, it is much safer to be a little conservative in estimating for the heat emission than to run the risk of a faulty job which cannot be cured without very expensive structural alterations.

I suggest, therefore, that if English and other European heating engineers are considering some changes in their approach towards radiant heating methods, and are looking to America for ideas, it will be much safer for them to aim for a correct estimation of heat losses, and adhere to emission factors which have given good results over a number of years without cracks in building material, disintegration of fabrics, and biological reactions of which we know very little. I have no motive in adhering to the lower emission figures which, over the years, I have found to agree fairly close to the actual facts, and it is very gratifying to note that the 1951 Guide presents charts which in some respects follow very closely the recommendations I have given for several years.

I believe in time we shall have more accurate values for *U* prepared for us to suit present methods of heating and modern types of construction, and then we may be able to work out a balance sheet with greater satisfaction to ourselves and to those who are now standing on the sidelines wondering when we shall agree on the details. It is, however, very disconcerting in the meantime to those engineers and architects who have to estimate the heat losses for large buildings, without knowing exactly how much to reduce the present established values of *U* for various types of construction.

I hope, therefore, that those interested in these important problems will consider the situation and support efforts to obtain all the information possible. In this way, a large number will benefit.

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## Temperature Control Aids Nylon Production

Marked improvement in the efficiency and quality of nylon production through new methods of temperature measurement and control during processing was predicted by a textile industry expert. The key to the new approach is a "radiamatic pyrometer" which measures the actual temperature of the fabric itself during processing, instead of just the air surrounding it.

J. D. MacNamara, textile industry sales manager for the Industrial Division of Minneapolis-Honeywell explained that this new, low-range temperature measuring device, recently developed by his company has taken much of the guesswork out of important finishing operations, reducing processing time while at the same time improving quality.

By means of this new device, the temperature of the fabric itself is measured. Actually, it measures the radiated heat energy from the cloth by focusing this radiation through a lens onto sensitive elements. This is much the same way sun's rays are focused through a magnifying glass. It can do this from as far away as one foot, an important consideration where it is impractical or impossible to make physical contact. Temperature control is important for too high a temperature will destroy the nylon fabric by melting it.

# Abstracts AND Reviews

*Publications abstracted in this department should be ordered direct from publisher.*

## NDHA PROCEEDINGS

The National District Heating Association has just published the official proceedings of its fortieth annual meeting held at Swampscott, Mass., in 1949. It contains not only the various papers presented at this annual meeting, but also the discussions that followed, committee reports and membership list of the association.

*1949 Proceedings of the National District Heating Association. Cloth bound, 6 x 9 inches, 338 pages. Published by the National District Heating Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. Price* $10.

## TECHNICAL WRITING

Intended for use by students in technical colleges, Technical Reporting by Joseph N. Ulman, Jr., Massachusetts Institute of Technology, is designed to help the student convey information and ideas accurately through oral and written communication.

Not only does this book cover proper grammatical construction in writing, but it has chapters on writing style, use of tables, and visual presentation of material. An appendix has two specimens of formal reports, and examples of good letters.

*Technical Reporting, by J. N. Ulman, Jr. Cloth bound, 6½ x 9¼ inches, 289 pages. Published by Henry Holt & Co., 383 Madison Ave., New York 17, N. Y. Price, $4.75.*

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MANUAL FOR DESIGN OF BOX-PLENUM TYPE AIR CONDITIONING DUCT SYSTEMS—Project DGR-2-AC has been issued by American Gas Association on Manual For the Design of Box-Plenum Type Air Conditioning Duct Systems. Because of the cost of conventional air duct systems in the winter, summer and all-year air conditioning installations in residences, consideration was directed to use of the box-plenum air distribution system. This manual covers the necessary design procedure. The data collected resulted from an investigation conducted at the University of Illinois. American Gas Association, 420 Lexington Avenue, New York 17, N. Y. Price, $1.00.

PLUMBING FIXTURE ARRANGEMENT—The first of a series of construction aid pamphlets, designed to assist builders to conserve materials and to reduce building costs, has been issued by the Division of Research, Housing and Home Finance Agency. It covers room orientation, fixture arrangement, apparatus location, and other considerations that may affect economy in plumbing installations. This pamphlet is Construction Aid Series No. 1 and may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Price, 15 cents.

RING-JOINT GASKETS AND GROOVES FOR STEEL PIPE FLANGES—The Heating, Piping and Air Conditioning Contractors National Association, Manufacturers Standardization Society of the Valve and Fittings Industry, and The American Society of Mechanical Engineers are sponsors of Standard ASA B16.20-1952 on ring-joint gaskets and grooves for steel pipe flanges. While such gaskets and grooves probably originated in the boiler field, their use has been expanded steadily as temperatures and pressures increased in steam plants. American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y. Price, $1.

FIRE TESTS OF GUNITE SLABS AND PARTITIONS—Results of tests conducted by the National Bureau of Standards to investigate properties of gunite in slabs and partitions when subjected to standard fire exposures are presented in Report BMS131. In addition to reporting the fire-endurance limits of gunite of 1:4 mix, the publication presents a means for improving the fire resistance of the concrete by modifying the aggregate. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 15 cents.

SELECTION OF GAS-MAKING OILS—Two important reports have been issued by the Institute of Gas Technology, affiliated with the Illinois Institute of Technology, Chicago, Illinois. Research Bulletin 9 is on Selection of Oils for Carbureted Water Gas and Research Bulletin 12 is on Selection of Oils for High Btu Oil Gas. Both are coauthored by E. S. Pettyjohn, the Institute's Director, and H. R. Linden, assistant research director. These reports present data on the relationships of the physical and chemical characteristics of petroleum fractions and of the operating variables, with the enriching values and with the qualities and quantities of the gaseous and liquid products. Institute of Gas Technology, Technology Center, Chicago 16, Ill. Report No. 9, $4.00, Report No. 12, $5.00.

CONSERVATION IN BUILDING CONSTRUCTION—The Study of Conservation in Building Construction was performed by the Building Research Advisory Board under a contract between the Defense Production Administration and the National Academy of Sciences. A final report on this study is now available. Results of this study include proposals such as revisions of technical standards by technical bodies responsible for respective standards, indications of research needed to produce criteria or technical advancements necessary for conservation, proposals as guides to the designer to attain conservation through economy and efficiency in practice and recommendations to the government for conservation in federal building construction. Building Research Advisory Board, Division of Engineering and Industrial Research, 2101 Constitution Avenue, Washington 25, D. C.

# NEWS OF EQUIPMENT AND MATERIALS

**Use the prepaid postcard opposite page 127 for securing additional information on items described in this department.**

## New High Temperature Insulation

A new ceramic fiber, trademarked Fiberfrax, possessing unusual resistance to heat and unusual electrical properties, is announced by Carborundum Co., Niagara Falls, N. Y. The new fiber was developed by combining aluminum oxide and sand. Since it is made at extremely high temperatures of inert earthy materials, the fiber possesses great heat resistance, will not lose its properties at temperatures up to 2,300 deg., and does not soften at temperatures approaching 3,000 deg. Natural asbestos cannot be used at such temperatures.

The fiber is made by melting aluminum oxide and silica in an electric furnace, then subjecting a stream of the molten material to a blast of air. The result is a fluffy, white, cotton-like mass made up of random arrangements of extremely fine fibers. The fibers are up to three inches in length, have an average thickness about one-twenty-fifth that of a human hair, about one-fourth that of fine silk. As blown, the fiber weighs about 2 pounds per cu. ft. It may eventually be processed into felted blankets, firmly bonded batts, tape, or paper-like forms. Illustration shows ¼ inch thick mat insulating the girl's hand from a Bunsen burner flame.

The thermal properties of the fiber have led to field tests of the material as high-temperature insulation in combustion and exhaust systems of jet engines. Light weight helps in this application. Thermal resistance also makes the new fiber a highly competitive material as an insulating refractory for high-temperature furnaces used for heat-treating metal, producing ceramic ware and similar applications where high-quality refractory insulating brick is now standard.

**More information? Circle Item 1 on postcard, page 127**

## Cold Galvanizing Process

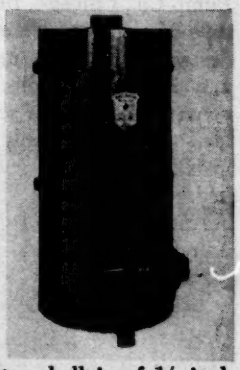
A new method of cold galvanizing for surface protection of steel and iron is announced by Galvanite Corp., New York, N. Y. The new process, which utilizes Galvanite cold galvanizing compound, is not a paint, but actually a cold galvanizing compound. Despite its lower cost it equals and in many cases is said to outperform other surface protection techniques including electroplating, hot dipping, cementation, spraying and painting.

The new coating may be applied with any ordinary paint brush, electric spray gun or by cold dip. Special equipment or personnel training is unnecessary.

**More information? Circle Item 2 on postcard, page 127**

## Fire Tube Oil, Gas Boiler

A vertical fire-tube boiler built on a tube within a tube principle has been introduced by Dewey-Shepard Boiler Co., Indianapolis, Ind. It is available in either oil (illustrated) or gas models.



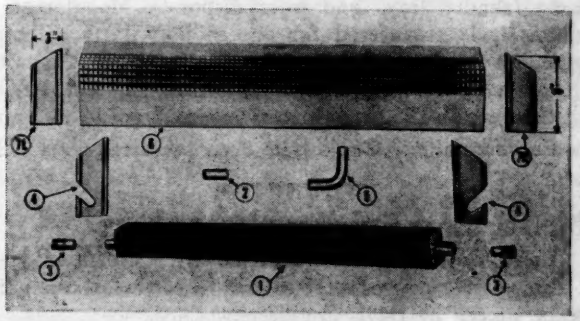
All units are jacketed with fibre-glass insulation, are of welded construction, and an efficiency of 80% is claimed. They are available in units with capacities from 95,000 to 1,000,000 Btu per hour.

Burner, of the single orifice type, has a deflector overhead. Outer shell is of ½ inch plate, inner shell of 5/16 inch construction. Each heater has multiple 2 inch brass cleanout plugs.

**More information? Circle Item 3 on postcard, page 127**

## Convector Fitted On-the-Job

A convector for baseboard application which is said to eliminate the necessity of taking close measurements and ordering specific sizes, and enables the contractor to



do all the fitting and cutting on-the-job, is announced by Rempe Co., Chicago, Ill.

Part 1 (see illustration) consists of a copper tube convector with aluminum fins expanded on to the tube. It is available in 10 ft lengths. It can be cut on-the-job to the desired length or two or more lengths may be joined.

For rapid installation, wall mounting brackets (4) are furnished, to be spaced on 54-inch centers. After mounting of wall brackets, cutting of convector to length, soldering of copper sleeves (2) and spuds (3), the convector is slipped into slots in the wall brackets, connections made to supply and return. Part 5 is a copper bend for joining convectors on corner installations.

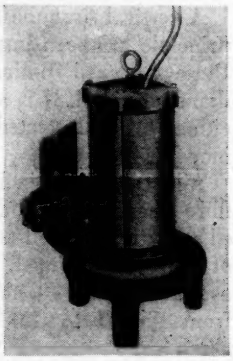
Formed steel cover (6) is available in 10 ft lengths. This can be cut easily to fit. End pieces (7L) and (7R) are used where convector does not end at a wall. Cover is painted with primer coat and can be finished on the job to match room color scheme.

Capacity is 4.50 sq ft EDR per lineal foot at one lb steam pressure with air at average temperature of 70 deg. Convector can be used for either steam or hot water.

**More information? Circle Item 4 on postcard, page 127**

## Compact Sewage Ejector

A new principle in sewage ejection has been developed and incorporated in the Submersible Screenless Sewage Ejector introduced by Weil Pump Co., Chicago, Ill. This new type of pump and motor unit is designed to operate under water and is much smaller than the conventional type of sewage ejector so that it is ideally suited for installations where space is limited.



Automatic control of this unit is by electrode with no moving parts, which permits a completely below floor level installation. The discharge pipe and the waterproof electric cable are all that extend above the floor. However, where unusual conditions exist the conventional type of float switch can be used.

Because of the simplicity of this unit it is easily installed in a tile or cast iron basin at low cost. Because of the waterproof nature of the unit, it is suitable for installation in underground vaults outside of buildings. The impeller is of a new design and the finest non-clog impeller that has ever been developed for sewage ejectors.

The unit has been designed to pump all sewage including rags and stringy material and to handle all waste from laundry trays and from disposals. Manufacturer claims it is engineered for one million starts without attention and has placed a five-year guarantee on the unit.

This ejector is available in two sizes—3- and 4-inch discharge with 1750 rpm motors in sizes from ½ to 3 hp.

**More information? Circle Item 5 on postcard, page 127**

## No. 6 Fuel Oil Preheater

The Type GF indirect gas fired fuel oil heater, said to be an entirely new concept in oil preheater construction, is introduced by Davis Engineering Corp., Elizabeth, N. J. Feature of the device is that it is independent of steam or hot water from the boiler being fired, the new heater providing its own supply of steam and using gas fuel as the primary source of heat energy.

The heater is in effect a combination of a small gas fired steam generator and a vertically mounted steam oil heater. An automatically controlled gas flame generates a supply of low pressure steam in the lower section of the unit, and this steam in turn passes in a closed circuit to the upper oil heating section. The condensed steam returns by gravity to the lower section, to be re-evaporated again. This closed steam—condensate cycle permits long periods of operation without the necessity of addition of make-up water.

Any type of gas can be used as the primary fuel. A burner designed for the gas to be used is furnished with the unit.

Low temperature forced circulation hot water heating systems, can, with this heater, use No. 6 fuel oil without the complicated preheating system now in use.

Bulletin 60L is available.

**More information? Circle Item 6 on postcard, page 127**

## High Pressure Bellows

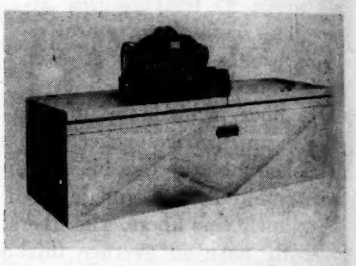
Production of bellows with pressure ratings in excess of 3,000 psi is announced by Clifford Mfg. Co., Waltham, Mass.

Bellows with ability to withstand pressures of this magnitude may afford designers and manufacturers important advantages in product design. This is especially true of cases in which a bellows is the ideal solution to a design problem but former limitations on pressure rating dictated that some alternate method be found.

**More information? Circle Item 7 on postcard, page 127**

## Industrial Liquid Chiller

A new liquid chiller, designed for use in varied commercial and industrial applications, is announced by Brunner Mfg. Co., Utica, N. Y. The unit is an ice builder as well as a chiller, building up quantities of ice in low requirement periods for use during peak load demands.



The interior of the cabinet is entirely lined with copper, with copper plates and copper coils used throughout to eliminate corrosion. The cabinet exterior is of 16 gage galvanized steel, aluminum optional, with aluminum doors and 4 inch cork insulation.

Liquids may be chilled by passing through the chiller cabinet itself, or by secondary circulation of chilled water piped from the unit. Each plate in the chiller is individually refrigerated, as well as the front and back walls of the cabinet. A mixing chamber pre-cools the liquid and passes it back and forth across the chiller plates and ice filled passes. Direction of liquid is reversed on an average of every three feet with a total travel of about 60 lineal feet throughout the cycle.

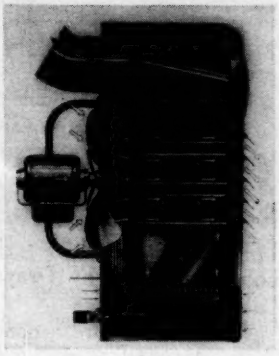
Refrigeration is provided by the company's slow speed open type condensing unit. Models ¼ to 7½ hp. are completely assembled at the factory, requiring only simple piping and electrical connections. Capacities range from 347 to 4960 pounds of usable ice daily.

In a dairy, a chiller installation will give added capacity by lowering temperatures of surface coolers for milk. Bottling plants use this equipment to advantage in reducing tap water temperature to near freezing for best bottling results. This equipment can also be used in bakeries to cool jackets on dough mixers, in poultry processing plants to provide ample cold water to cool slaughtered birds, in industrial plants to cool oil and grinding compounds allowing closer tolerances. Chemicals, food, paper and numerous other industries are also large users of the chillers.

**More information? Circle Item 8 on postcard, page 127**

## Boiler Tube Gas Unit Heaters

A new streamlined line of gas-fired unit heaters is introduced by The Trane Co., La Crosse, Wis. Six units range in capacities from 50,000 to 230,000 Btu per hour input.



Heart of the new, competitively-priced design is the heat exchanger, built like a boiler with its horizontal steel tubes staggered to provide maximum areas of prime heat surface. Sized for smooth, quiet air passage, the steel tubes are rolled into heavy end sheets, boiler tube style, and are fortified with additional outer and inner rolled flanges. No cement or gaskets are used in the heat exchanger's locked seam construction. Air-tight operation is assured by the continuous seam welding of end plates to sides. A brush can be passed between the tubes for easy cleaning.

The heat generator includes burner heads and mixing tubes of one-piece cast iron construction. They are intended for natural, manufactured, mixed, or liquified petroleum gas. Burners, pilot, and control valves are combined in one removable drawer-type assembly for easy maintenance. Built-in safety controls include a high-limit switch to prevent overheating, and automatic cutoff of both pilot light and main gas supply.

An integral draft diverter allows back and down drafts to by-pass the burner assembly without affecting normal operation.

Curved louvers direct heated air, which accumulates at the ceiling, back down to the worker comfort zone. Optional equipment is the company's louver fin diffuser, which provides both lateral and vertical control of the air stream.

Bulletin DS-347 is obtainable.

More information? Circle Item 9 on postcard, page 127

## Relay Silences, Resets Signals

An alarm-silencing relay that is automatically reset is introduced by the industrial division, Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., to replace old-style manual alarm shut-offs for processing control systems.

Whenever a control system includes an audible alarm such as a horn or bell, it is often necessary to use manual means to turn off the signal after it has been energized. This is usually done by wiring the alarm through a knife-switch or by using a reset pushbutton. After the conditions that caused an alarm have been corrected, a worker may forget to close the switch or push the reset button with the result that the alarm becomes inoperative and the process goes forward without benefit of the control.

The new relay provides a method for shutting down the alarm while insuring automatic reset when the alarm condition is corrected. A red pilot light on the relay warns until the alarm circuit has been cleared. In operation, when the controller switch makes contact, the alarm and pilot light are energized. When the operator pushes a button on the front of the relay, the alarm is stopped, but the pilot light remains energized. The light will go out when the improper condition is corrected and the relay is then ready for the next cycle.

More information? Circle Item 10 on postcard, page 127

## Multi-Use Industrial Fan

A new, rugged industrial fan built with either an air handling, a materials handling, or a long shavings wheel, is available from Westinghouse Electric Corp., Sturtevant Div., Boston, Mass. The fan is made in 11 sizes with capacities ranging from 670 to 44,000 cfm and pressures up to 16 in. water gage.

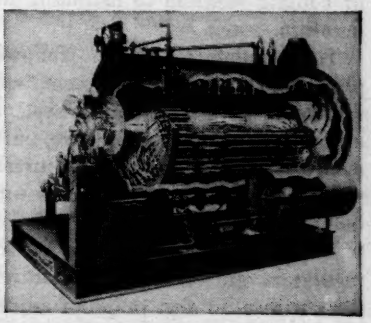
The air handling wheel has backwardly-inclined blades featuring low power consumption over a wide range of volumes and pressures. It is particularly suitable for exhausting smoke, fumes and light dusts. The heavy-duty, straight-bladed, side-plated, materials handling wheel combines high fan efficiency with its material handling features. Conveying of sawdust, granular materials and chips are typical applications of this type of wheel. The long shavings wheel has no side plates and has been designed for handling long, stringy fibers.

Standard accessories for the fan include both bolted and quick opening type access doors, flanged outlets and inlets, and outlet dampers. It is available with a variety of special coatings, and can also be built of special metals to meet explosion-proof or anti-corrosion specifications. For high temperature applications, special cooling accessories are available.

More information? Circle Item 11 on postcard, page 127

## Packaged Generator in 16 Sizes

The Powermaster automatic packaged steam generator is being built in 16 sizes by Orr & Sembower, Inc., Reading, Pa. It has a three-pass internal furnace construction and is equipped with Voriflow burners for light or heavy oil or gas fuels. Combination burners are also available.



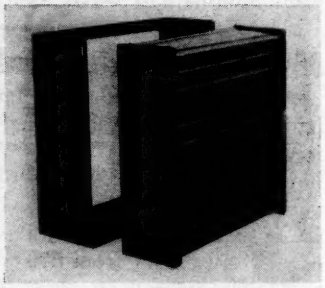
Combustion gases travel through the central combustion tube, reversing their flow back through the lower bank of tubes, then again toward the rear branching through two lateral banks of tubes. Boiler feed and condensate handling system is optional. A completely integrated control system and interlocking safety devices are part of each unit.

The boilers range in capacity from 15 to 500 hp. for pressures up to 250 psi.

More information? Circle Item 12 on postcard, page 127

## Activated Carbon Cell

A new Dorex heavy duty activated carbon air recovery filter cell is announced by W. B. Connor Engineering Corp., Danbury, Conn. Designated as the Type T-42 cell, it has a thicker carbon bed than the T-28 cell and slightly greater resistance to air flow for longer contact with the filter media.



Rated at 700 cfm, the T-42 cell is recommended for odor removal applications other than those in typical comfort conditioning systems, such as the recovery of recirculated air in industrial plants and purification of contaminated exhaust and intake air.

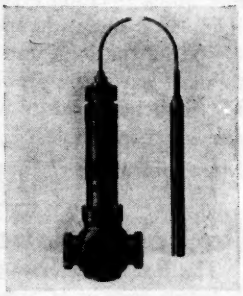
Photo includes supporting frame and detachable test element which indicates service life.

Bulletin 117-C is available.

**More information? Circle Item 13 on postcard, page 127**

## Line of Temperature Regulators

Series V, a new line of self-operated temperature regulators, is announced by Farris Stacon Corp., Palisades Park, N. J. Designed in either direct or reverse acting types for heating and cooling applications, these regulators can be employed to handle, through the valves, steam, liquids, gases and all fluids not corrosive to brass.



The regulators operate on the principle of liquid expansion. Since the liquid expansion is proportional to increments of temperature, the valve movement is gradual. The result is a gentle, but positive, throttling, where the valve supplies only enough steam or cooling medium to maintain the desired control temperature.

The regulators have the following features: field replaceable thermostatic system, easily replaced without removing valve from piping system; tight shut-off; operating principle insures positive, uniform throttling action; overload protection; dial adjustment; compact, sturdy unit. The ½-inch regulator is only approximately 8½ inches overall.

Available in sizes ranging from ¼ to 4 inches, these regulators will control temperatures between 25 and 275 deg., with a 50 deg. range of adjustment.

**More information? Circle Item 14 on postcard, page 127**

## Airmotor Valve Operator

A new airmotor diaphragm-type valve operator has been added to its line by General Controls Co., Glendale, Calif. It is designed for use on any of the company's valves, normally open, normally closed, three-way or slides. It operates by pneumatic pressure applied to the chamber above the diaphragm and is adaptable for manual or remote control systems.

The operator is ideal for modulating control of valves where accurate control of flow is desired with applied diaphragm pressure. Mounting space is provided for control instruments and type V-301 and V-302 pneumatic pressure regulators.

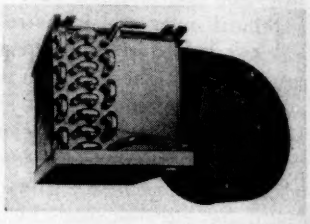
Operators are available in 13- and 16-inch diaphragm sizes, with other sizes available by special order.

**More information? Circle Item 15 on postcard, page 127**

## Room Air Conditioners

The Spotaire HRC series room air conditioner has been introduced by Drayer-Hanson, Inc., Los Angeles, Calif.

The units feature a concealed installation and cabinet enclosed models with 3, 4, or 6 rows of coils. A large fan revolving at low speed is said to provide silent operation.



The company reports that these units possess the adequacy and quietness of a central duct system at a 30% saving without sacrificing any of the advantages of an individual unit system. They may be specified for hospitals, motels, hotels, offices and residences.

The units heat, coal, filter, ventilate and recirculate air and are available for hot or cold water and for direct expansion refrigeration. A catalog is available.

**More information? Circle Item 16 on postcard, page 127**

## Vacuum Cleaning Tubing

Welded steel tubing and fittings now come in standard sizes for use in industrial, commercial, educational and institutional vacuum cleaning systems. Called H-P VacuFlo fittings, they are made by H-P Products, Inc., Louisville, Ohio.

Simple installations are effected because tubes are easily inserted in the flanged ends of the new fittings, and joints sealed on the job by brazing or welding. Various types of mastic for joining are also proving satisfactory. Ease of handling, storing and lower shipping charges are favorable factors.

Another important feature is the greater volume of carrying capacity gained over cast or drainage type fittings of similar size . . . plus elimination of deadhead pockets in tees and tee wyes that allowed dirt and foreign matter to collect in such manner that systems could become clogged.

Ells, tees, tee wyes, bushings, couplings, and other necessary fittings are being produced in 2-, 2½- and 3-inch stock sizes.

**More information? Circle Item 17 on postcard, page 127**

## Pipe Cutter for Steel, Cast Iron

A new portable power pipe cutter which cuts and bevels steel pipe on the job is introduced by SpringLoad Mfg. Corp., Seattle, Wash. Features are that it cuts and bevels steel pipe in one operation, cuts cast iron pipe without splits or breaks, is portable, light weight, adjustable size, has adaptability to power from various sources, hinged construction which permits its use on pipe already installed, and speed of cutting.

Cuts are perfectly true with a flat edge on the inner circumference, ready for immediate welding. The bevel cut is made at a 60 degree included angle, but where codes in any area require a different angle, suitable bits can be furnished.

Two cutter sizes are available. One is for 6, 8 and 10 inch pipe, inclusive; the other for 12, 14 and 16 inch pipe, inclusive. A 2 to 6 inch size is projected for use in the steam and refrigeration fields.

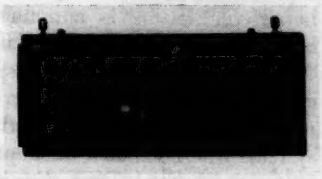
Power from any of several sources facilitates field use. A ¾ inch slow speed electric drill, the equivalent in an air drill, or a flexible shaft on a small gasoline motor geared to slow speed, are all acceptable.

The power cutter is made with a cast aluminum housing finished in blue enamel, with working parts of the machined steel. The tool automatically increases its depth of cut with every revolution, and also compensates for out-of-round pipe. It is held on the pipe with drive points which hold it firmly in position during the cutting. The replaceable cutter bits are of high speed steel. Oiling of the cut is also automatic.

**More information? Circle Item 18 on postcard, page 127**

## Two Oil or Gas Lowboy Units

Two new horizontal oil or gas furnaces are in production by Delta Heating Corp., Trenton, N. J. The larger model has an output of 210,000 Btu per hour, the smaller 160,000 Btu per hour.



Both models are fired with company's flanged gun-type oil burner and are inter-changeable for use with gas, using an inshot type gas burner. Casing measurements for both units: length 62 inches, height 30 inches, width 30 inches.

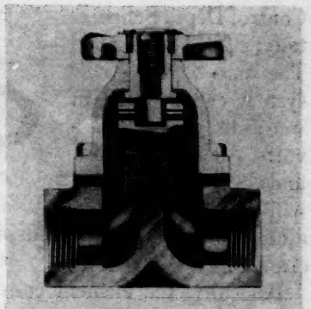
These larger size furnaces are commonly used to heat commercial buildings by direct air-blast or attached to duct work. Hanger-posts are provided for suspending furnace from the ceiling, or four pipe legs can be fastened to the female couplings provided at the bottom to support the furnace when used as a portable unit, or when set upon a base.

The furnaces have been designated Models SU-210 and SU-160.

**More information? Circle Item 19 on postcard, page 127**

## Diaphragm Valves for Chemicals

A line of general-purpose diaphragm valves, combining the corrosion resistance of Ace Parian with the Saunders diaphragm principle, said to be ideal for handling a wide variety of corrosion chemicals, is introduced by American Hard Rubber Co., New York, N. Y. Tough, odorless, tasteless, and non-toxic, they are also recommended for handling many food products.



Metal never comes in contact with the liquids handled. The valve body is molded of Ace Parian, a plastic compound in the polyethylene family. The diaphragm may be rubber, neoprene, or polyethylene as required. The bonnet assembly is sealed off from the solution, and the valve has no stuffing box to leak. It can be serviced without removing from the line, and all parts are interchangeable.

The valves are available in all standard sizes from ½ to 2 inches, threaded for standard pipe threads.

**More information? Circle Item 20 on postcard, page 127**

## Industrial Chilling Machine

A compact industrial chilling machine for testing procedures with temperature requirements of —10 to —80 deg. is available from Sub-Zero Products, Cincinnati, Ohio.

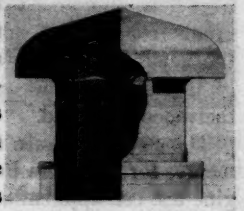
Known as Model R-70, this unit is of particular value for testing of parts, instruments, etc., that must be able to withstand the effects of extreme cold.

It is equipped with a chilling chamber 30 by 18 by 33 inches deep, with more than 22 square feet of freezing surface. The unit has a thermal capacity of 800 Btu per hour at —70 deg.

**More information? Circle Item 21 on postcard, page 127**

## Low Type Fan Ventilator

Designed to meet modern architectural requirements for a highly efficient power driven fan ventilator that is low in height and of pleasing and inconspicuous design, a low type ventilator is introduced by The Burt Mfg. Co., Akron, Ohio. Capacity, weather-proofing, quietness and efficiency are combined with simplicity of installation in the new unit. It may be used either as an exhaust fan ventilator or as a fresh air supply unit.



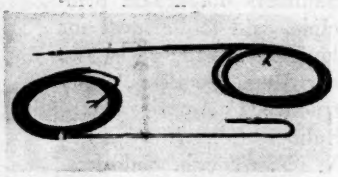
The ventilator can be supplied with either a direct motor-driven fan or with a V-belt and pulley drive. Sizes range from 12 to 60 inches. Standard construction is prime galvanized steel but other material, such as aluminum and stainless steel, may be employed for special purpose use.

Bulletin SPV-16 is available.

**More information? Circle Item 22 on postcard, page 127**

## Sewage Liquid Level Control

An electrical system for sewage and water level control and indication is announced by General Electric Co., Control Dept., Schenectady, N. Y. Called Thermasul, the new system can be used in wet wells, sumps, reservoirs, elevated tanks, and standpipes, and will control pump motors, pump motor speeds, and supervisory and alarm circuits.



Basically, the element consists of a temperature-sensitive, sintered-sulphite compound around which is wound a resistance heater; the whole assembly is hermetically sealed in a stainless-steel tube. In air, resistance of the element is low because the heater keeps the level detector approximately 500 deg. above the ambient air temperature. When the detector is immersed in liquid, however, the heat is conducted away and the resistance of the element jumps up rapidly, operating a small, remotely-located relay.

Thus, the element acts as a switch, opening and closing the relay with the presence or absence of liquid. The relay, in turn, can be used to control pump motors, and circuits for alarm, supervisory, and control equipment. With the addition of standard accessories, the element permits great versatility in pump programming.

The non-corrodible construction and self-cleaning characteristics of the new device are said to make it exceptionally useful for unattended locations.

These systems can be mounted with simple pipe supports. Three conductor cable connections from level detectors to auxiliary control are the only electrical connections required with the exception of power-line pick-up. There are no moving parts to jam or bind, no electrodes to be shorted or otherwise fouled by deposits, and Thermasul is not adversely affected by greasy films or ice.

**More information? Circle Item 23 on postcard, page 127**

## New Pyrometer Accessories

Several new developments in pyrometer accessories have been announced by the Industrial Division of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. Among the new numbers the company reported three new types of insulated thermocouple wires and a new screw cover thermocouple head.

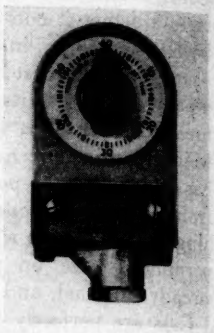
The new wires are for sub-zero temperature measurements, for refrigeration and air conditioning work, engine test cell applications, and for food canning involving heat-penetration studies, the measuring of canning retort temperatures and others.

The latest wire additions include insulation made of plasticized vinyl chloride for ambient temperatures between 20 deg. below zero and 225 deg. above zero, a non-impregnated glass for ambient temperature up to 1200 deg., and a fibrous silica for ambient temperatures up to 2000 deg.

**More information? Circle Item 24 on postcard, page 127**

## Non-Electric Gas Shut Off

The Gastimer, an automatic gas shutoff, with which electric current is not required, is being manufactured by R. B. Enterprises, Inc., Detroit, Mich. This precision timing mechanism can be set for any burning period up to one hour. Gas is automatically and positively shut off and a bell signal is sounded at the selected time.



The device is a low-cost, self-contained unit that is simple to install in any position. It materially increases the convenience, economy and safety of gas appliances that are manually operated. It has advantages for manufacturers of incinerators, water heaters, laundry stoves, hot plates and room heaters, whose product do not warrant the extra cost of electrically-operated controls.

The solid-brass valve has ½ inch female inlet and outlet. For uninterrupted gas flow, it has a manual hold-open feature. The timer mechanism may be removed without removing the valve or cutting off the gas. Pilot take-off is available upon request.

Capacity of the valve is 47,900 Btu per hour of 1,000 Btu per cu ft natural gas or 25,800 Btu per hour of 500 Btu per cu ft manufactured gas.

**More information? Circle Item 25 on postcard, page 127**

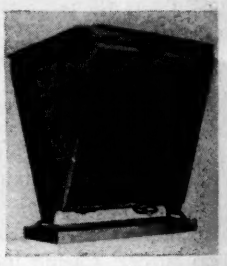
## Expansion Joints Improved

Significant design improvements in its Flexon expansion joints, and the addition of a 3-inch size to the line, are announced by Flexonics Corp., Maywood, Ill.

**More information? Circle Item 26 on postcard, page 127**

## Grease Eliminator for Ducts

The Far-Air grease eliminator which prevents accumulation of grease and lint in duct systems, protects motor and blower equipment, reduces maintenance costs and provides better ventilation, is announced by Farr Co., Los Angeles, Calif.



The grease eliminator is especially designed for installation in restaurant kitchen ventilating systems where exhaust ducts present a fire hazard. Duct cleaning with attendant inconvenience as well as increased maintenance costs is virtually eliminated by this inexpensive unit, the manufacturer claims.

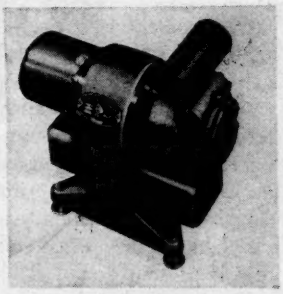
A tray which catches dripping grease that has been accumulated by the filters is suspended below the unit for greater cleanliness. Filters are quickly removed and snapped back in place. They may be cleaned by flushing under a hot water tap or by running through the dishwasher.

The eliminator is available in a wide range of sizes and finishes to match existing kitchen equipment.

**More information? Circle Item 27 on postcard, page 127**

## 2-Stage Fuel Unit Burner

A low pressure oil burner equipped with a 2-stage self-purging fuel pumping unit is introduced by Combustioneer Div., The Steel Products Engineering Co., Springfield, Ohio. Developed to provide an increased suction lift capacity and to permit rapid purging of air bubbles from the purging reservoir, the unit incorporates two pumping elements operating in conjunction with a purging reservoir and a pressure chamber. As oil is drawn into the purging reservoir in the first stage of the pumping cycle, air bubbles rise to the top of the reservoir and are by-passed through the return line to the storage tank. Pure oil in the lower portion of the reservoir is then drawn into the pressure chamber by the secondary pump. Thus, oil entirely free of air is routed to the metering piston for delivery to the burner nozzle.



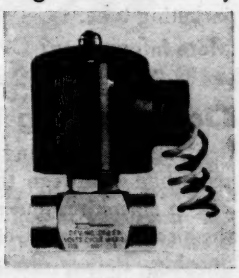
Designed to function with single or two-line systems the burner will draw oil from distances up to 38 feet horizontally, plus 15 feet vertically, without the necessity of an extra suction pump.

Motivated by the flow of oil, with no mechanical linkage, the metering piston permits the selection of exact fuel requirements ranging from .5 to 4.0 gph, while the burner is operating. By repositioning a sliding air cone, correct quantities of air can also be controlled without stopping the burner.

**More information? Circle Item 28 on postcard, page 127**

## All-Purpose Solenoid Valve

Designed for wide range of industrial applications, the new Model 67 solenoid valve is being manufactured by A-P Controls Corp., Milwaukee, Wis. It is offered in two body styles and with two types of needle and seat construction.



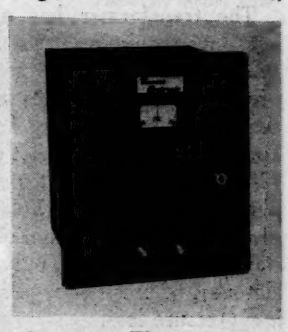
Where positive seal-off is required, the valve is furnished with a synthetic resilient disk-type needle, seating against a stainless-steel orifice. This provides bubble-tight operation under the most severe and critical conditions. For other applications, the valve is furnished with stainless-steel needle, in combination with a high-strength, corrosion-resistant stainless-steel valve seat. The design prevents ovaling and wire-drawing of the seat, even after long periods of continuous operation.

Available in two body styles, 3/8 inch female pipe or 1/2 inch O.D. tube sweat connections, the valve can be used for air, oil, water, gasoline, alcohol, detergents, refrigerants, butane, propane or other noncorrosive liquids and gases. Capacity on water is 78 gph and on refrigerant applications one ton, Freon 12. Working pressure up to 300 psi. Operating differential; liquid lift up to 130 psi, air and gases 250 psi, refrigerants 200 psi.

**More information? Circle Item 29 on postcard, page 127**

## Electronic Process Controller

For accurately controlling operating temperatures ranging from —100 deg. to +600 deg., Thermo Electric Co., Inc., Fair Lawn, N. J., has introduced the Thermo Electronic temperature controllers using resistance bulb sensitive elements.



These instruments are built with single or duplex control action and are available in six different temperature ranges. The standard resistance bulbs, designed for use with these controllers, cover practically all process applications. The instrument has a relay with load contacts for operating heating elements, motor starters, electric valves, and signal contacts for the two red and green lights on the instrument door. These signal lights are visible over a wide angle at distances up to 100 feet.

When the temperature at the resistance bulb deviates as little as 0.1 deg. from the control point setting, the instrument takes immediate corrective action. The control action is continuous. The electrical measuring system completely eliminates time lags in transmitting temperature changes from the sensitive element to the instrument.

The control relay is the only moving part in this instrument, which operates completely on AC current. Standard vacuum tubes are used in the electronic circuit.

**More information? Circle Item 30 on postcard, page 127**

## Simple Flow Rate Regulator

Recent modifications in its direct-acting flow rate regulator are reported by W. A. Kates Co., Deerfield, Ill., to provide greater accuracy and improved performance on liquid flow control problems.

Designed for use wherever liquids are handled, the regulator is well-adapted to such jobs as blending and proportioning, solvent extraction, controlling filter effluent, water treatment and deionizing, chemical process control, evaporator influx, diluting of bulk heavy chemicals, and on many other jobs where accurate control of flow rate has resulted in a better product, increased economy, and smoother production schedules.

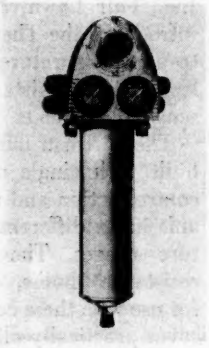
Operation of this low-cost regulator is simple. Set the calibrated dial to the desired flow rate and despite pressure fluctuations in either the inlet or outlet lines, the regulator automatically holds flow to the set rate.

Available with standard capacities ranging from 0.1 to 100 gpm of water, the regulators are accurate to within 3%. When desired, larger capacities and greater accuracy can be furnished.

**More information? Circle Item 31 on postcard, page 127**

## Compressed Air Transformer

The HLD air transformer is introduced by The De-Vilbiss Co., Toledo, Ohio.



The transformer has a built-in two-stage regulating principle which provides for easier edjustment of pressures, requiring only finger tip control of the adjusting knob. The knob actuates a small pilot regulator which in turn operates the diaphragm of the large regulator, thus giving ease of operation. The two-stage regulator also provides for closeness of pressure regulation and low pressure loss.

Oil and moisture, present in all compressed air lines, is eliminated by the transformer which traps the liquids and delivers clean air to all outlets. In tests, 97% of entrained water was removed from 100 cfm or air at 100 pounds pressure.

The transformer has two regulated air outlets and two unregulated. It has a capacity of 100 cfm. Oil and moisture captured in the condenser tube is drained by a pull-push drain knob. Pulling the knob down closes the drain and pushing it up opens it.

**More information? Circle Item 32 on postcard, page 127**

## Anti-Corrosion Black Finish

A new jet black finish for iron and steel and having ten times the corrosion resistance of conventional blacks has been developed by Parker Rust Proof Co., Detroit, Mich. It is available under the trade name Parco Black.

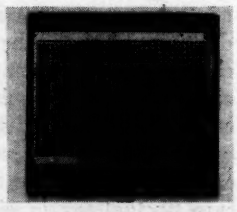
It is used in water solution at low temperatures. Parts to be treated are immersed for 15 to 30 minutes in the processing bath, then are rinsed and dried. After oiling or waxing, the finish is ready for service.

Advantages are several: The processing bath is non-caustic, simple to build and easy to control. Operating temperatures low. Any part which can be immersed in the tank can be treated. It is suitable for machined or threaded parts.

**More information? Circle Item 33 on postcard, page 127**

## Electric Radiant Heater

A radiant ceramic heater has been introduced by Heatmore, Inc., New York, N. Y. The heater has high resistance wire embedded in a ceramic composition which, when heated, emits longer infrared wavelengths.



The device is safe and even if accidentally touched, will not burn. Manufacturer claims that cheesecloth in continuous contact will not ignite. Device is suitable for use in any room for supplementary or primary heating. It is made in a number of models, including the wall mounted panel type (illustrated) in four different sizes, a less expensive wall mounted panel type and the Series A portable type.

**More information? Circle Item 34 on postcard, page 127**

## Control for Dehumidifier

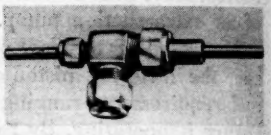
An automatic control for its Aqua-Sorber dehumidifier is announced by Walton Laboratories, Inc., Irvington, N. J.

The control is entirely automatic and reacts to the moisture content of the atmosphere rather than at pre-set timed intervals. Thus the dehumidifier operates only when necessary, an advantage over interval timed operation which turns on the dehumidifier whether moisture is present or not. The control saves on electric power consumption and is simple to install, being plugged into both power source and dehumidifier by standard cord and plugs.

**More information? Circle Item 35 on postcard, page 127**

## Heat Exchanger Tee

The new Swagelok heat exchanger tee is announced by Crawford Fitting Co., Cleveland, Ohio. It is available in brass, aluminum, steel, stainless steel and monel, and is precision-made for numerous uses throughout laboratories and process industries.



Designed for steam jacketing or temperature control of process lines. the tee is useful in all cases where it is necessary to effect an exchange of heat between coolants and process fluids. The small end of the fitting has been bored through the fitting to allow the tube to pass completely through the jacketed end.

The tee is available in sizes up to 1 inch O.D. for the jacketing tube.

**More information? Circle Item 36 on postcard, page 127**

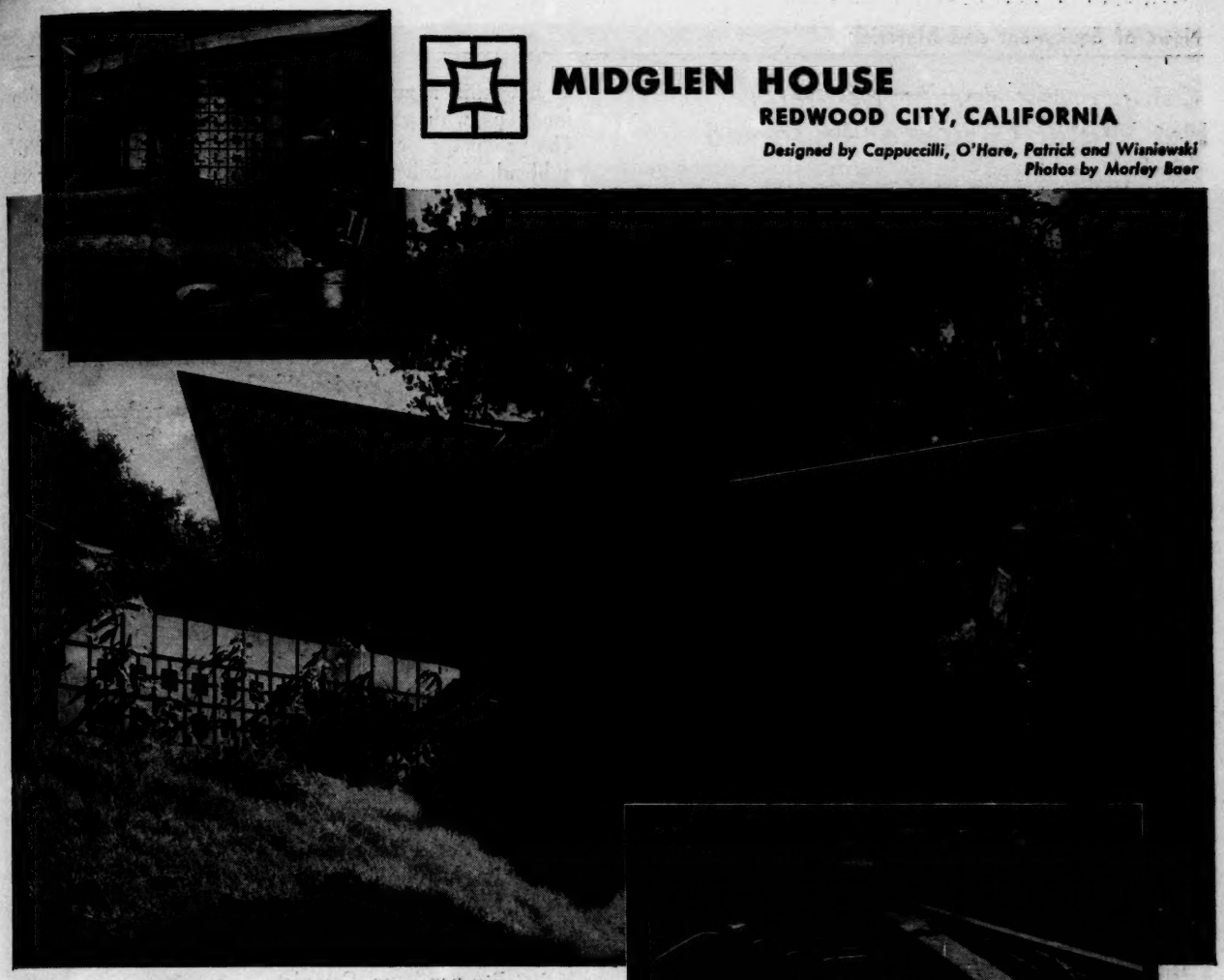
## Oak Flooring for Radiant Heat

Structures utilizing radiant heat have, for the most part, had to forego the use of hardwood floors because of the shrinking and swelling in alternate periods. With the production of Gothic Oak ready-finished hardwood flooring, Parkay, Inc., Louisville, Ky., believes that it has the solution to this problem. The manufacturer points out that this flooring is subject to the least dimensional change of flooring woods. For example, water immersion tests to determine relative swelling show that the coefficient of change of Gothic Oak is only one-half that of quartered oak and one-quarter that of plain oak. This flooring is installed quickly and economically. Once the concrete is dry, the flooring is applied directly to the subsurface with an adhesive. Once in place, the floor is ready for immediate use.

The flooring is available in two sizes, 8 x 8 inch units and 12 and 12 inch units made up of four 6 inch sections. Both units are 5/16 inches thick and have beveled edges.

**More information? Circle Item 37 on postcard, page 127**

(*Continued on page* 124)



## MIDGLEN HOUSE

**REDWOOD CITY, CALIFORNIA**

*Designed by Cappuccilli, O'Hare, Patrick and Wisniewski*
*Photos by Morley Baer*

# ANOTHER CASE OF *Copper* WHERE IT COUNTS

Built for gracious living and to take full advantage of its natural setting, the Midglen House is the last word in contemporary architectural design. Yet, new and modern as the design is, in two of the spots calling for the utmost dependability of materials, the oldest metal probably known to man, is employed . . . COPPER. Revere Copper Water Tube is used for radiant panel heating and hot and cold water lines. Midglen House was conceived and built by Cappuccilli, O'Hare, Patrick and Wisniewski. Redwood Plumbing Company, Inc., was the plumbing and heating contractor.

While present conditions may preclude the use of Revere Copper Water Tube for radiant panel heating, designers, architects, builders and contractors are using what tube they can get where it counts most. They have found, by experience, that it pays dividends in prestige, reputation and customer satisfaction.

See your Revere Distributor. He will advise you of the availability of materials and, in the event you wish to discuss your technical problems, put you in touch with Revere's Technical Advisory Service.

*(Top inset)*—SECTION OF THE CANTILEVERED living room at Midglen House. Radiant panel heating coils are embedded in integrally colored concrete floors.

*(Bottom inset)*—HERE YOU SEE the Revere Copper Water Tube fastened to the steel reinforcing, which was laid over 6" of gravel, preparatory to the pouring of the concrete. 1,700' of non-rusting Revere Copper Water Tube was used for radiant panel heating and water lines in sizes ranging from ½" to 1". When Revere Copper Water Tube is used the solder or compression fittings employed make it possible to use a thinner wall tube than is the case when threaded fittings are used, with a substantial saving in metal. Contractors prefer it because when 60' coils are used bending can be done by hand and fewer fittings are required, making installation easier and faster.

**REVERE**

**COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*
230 Park Avenue, New York 17, N. Y.

• • •

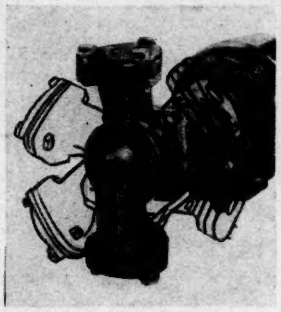
*Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere*

**SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY**

(*Continued from page* 122)

## Hot Water Circulator Improved

Several new features in its horizontal circulator for residential and industrial hot water heating systems are announced by Econo Products Co., New York, N. Y. The entire pump assembly can now be set quickly for any direction of flow—vertical, horizontal or any other angle, by loosening one nut instead of the usual four.



This feature is said to effect savings in cost by reducing installation time, makes the pump simple to adjust to any piping angle, and eliminates possible leakage because there is no need to remove bolts or gaskets. Another new feature is the bronze open fin impeller which gradually builds up circulation, giving a sustained head pressure without overloading the motor. This sustained head pressure is greater actual output power and is said to be especially suited for baseboard and radiant heat installations where high head pumps would ordinarily be required.

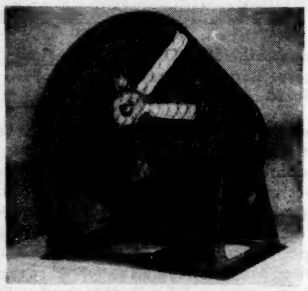
Neoprene vibration dampeners provide vibration-free sound insulation by eliminating metal-to-metal contact. The pump also has a flexible spring coupling which eases the starting torque, an automatic thermal overload switch, extra heavy oilite bearing, oversized waterway. Neoprene oil seal, stainless steel shaft, pinned rotary water seal and a large oil reservoir.

The circulators are available in ¾, 1 1¼ and 1½ inch sizes.

More information? Circle Item 38 on postcard, page 127

## Portable Axial Flow Fan

A portable utility fan for floor, wall or ceiling mounting has been introduced by Aerovent Fan Co., Inc., Piqua, Ohio. They are available in sizes from 16 to 36 inches.



The fans can be furnished with 2, 4, or 6 blades. They are intended for dissipation of fumes in industry or for cooling or drying where a continuous blast of air is required. They are recommended for use around furnaces, tube mills, ovens, kilns and similar points.

More information? Circle Item 39 on postcard, page 127

## Soldering and Welding Aluminum

Chemalloy, an improved and simplified means for soldering and welding aluminum is available from Chemalloy Associates, Santee, Calif. The method does not use a corrosive flux to solder aluminum oxide but will solder or weld any solid aluminum or zinc base metal regardless of how thin a gage, down to foil or screening. It also functions with galvanized surfaces on galvanized iron. The product is derived by introducing muriatic acid into a blend of molten metals and by-product wastes from Arizona smelting operations.

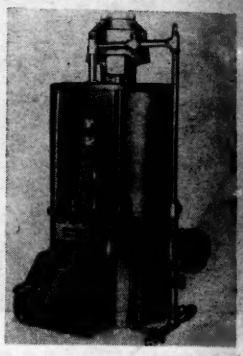
The product does not splatter or puddle during melting but flows as a silvery liquid easy to place on the metal at the spot to be joined. Equipment needed is any source of heat sufficient to develop about 800 degrees at point of weld. In general, the instructions needed are only to heat the aluminum until the Chemalloy melts in contact with it; then the Chemalloy is rubbed on.

The product is manufactured as cast rod, a common size being 3/16-inch triangular in lengths 12½ to 14 inches long. List price is $3 per lb.

More information? Circle Item 40 on postcard, page 127

## Gas Boiler-Burner Unit

An all-steel gas boiler-burner unit, model VGF, is the latest addition to the line of Federal Boiler Co., Inc., New York, N. Y. Incorporated in this unit is the company's copper tankless coils, providing 200 to 240 gallons of domestic hot water per hour. These units, with built-in coils eliminate the need for separate hot water heaters, and will last a lifetime, it is claimed.

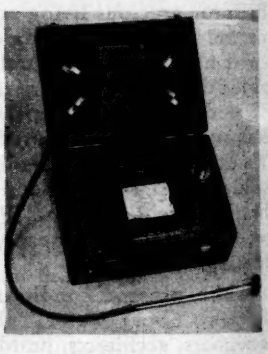


The boiler will operate on natural, mixed or manufactured gas. The AGA output rating is 76,800 Btu per hour. Complete engineering specifications are available.

More information? Circle Item 41 on postcard, page 127

## Moderate Price Air Meter

An air velocity measuring instrument of high accuracy in the moderate price range has been developed by Hastings Instrument Co., Hampton, Va. This Model H Air-Meter, operating on 90 to 135 volts A.C., is said to be accurate to plus or minus 2%. Velocities are measured by a sensitive thermopile located in the probe.



Two features incorporated in the instrument to increase accuracy of readings are the dual velocity ranges (10 to 750 and 750 to 5500 fpm) and an expanded low-range scale.

This meter is adaptable to applications requiring permanent or remote installations. A continuous calibration check is provided by the current set meter.

More information? Circle Item 42 on postcard, page 127

(*Continued on page* 126)

# The WORKABLE SHEET *is Galvanized Steel*

Bethlehem Galvanized Steel Sheets are simple to fabricate. They can be cut, formed, seamed and soldered with no difficulty, using ordinary shop tools. Smooth, good-looking sheet-metal jobs can be done in minimum time.

These easy-working sheets are made of strong, durable steel, either plain or copper-bearing. A spangled zinc coating protects them against corrosion. Their cost is low, and they give excellent service. Dollar for dollar there are no better sheets for all-around work than Bethlehem Galvanized Sheets.

**Bethlehem GALVANIZED Steel Sheets**

★ BETHLEHEM STEEL ★

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

**On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation**
***Export Distributor:* Bethlehem Steel Export Corporation**

(*Continued from page* 124)

## Radiant Front Radiator

A new radiant front radiator is announced by United States Radiator Corp., Detroit, Mich. It has a low silhouette that blends into any decorating scheme.

The new radiator combines both radiant and convected heat. It has an additional front air inlet to assure higher efficiency in any type of installation. Low in height—it is 20 inches high—the radiator can be used as a free-standing radiator or recessed in the wall. It forms its own cabinet and requires no separate enclosure. Matching snap-on grilles provide complete concealment of piping.

**More information? Circle Item 43 on postcard, page 127**

## Sensitive Automatic Sprinkler

An automatic sprinkler utilizing a solid organic chemical as its fusible element is introduced by Globe Automatic Sprinkler Co., Inc., New York, N. Y. It is said to open much closer to its rated temperature than has heretofore been deemed possible.

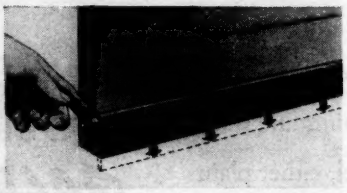
The unit is the first sprinkler utilizing a solid chemical for its fusible element. Because this chemical is solid, different compounds can be produced, each with a definite unchanging fusing temperature. This permits manufacturing an array of sprinklers that are unique in adaptability, with temperature ratings of 135, 160, 212, 280, 340 and 415 degrees.

In service, when surrounding atmosphere attains the temperature for which one of these sprinklers is rated, its fusible element of solid chemical changes to a liquid, thus opening the closure and permitting water to discharge.

**More information? Circle Item 44 on postcard, page 127**

## Stops Under Door Drafts

An automatic stop draft device for doors is introduced by Sentry Stop-A-Draft Co., Chicago, Ill. It consists of a long, strip-like metal casing 2 inches high and ¼-inch thick and of a length to correspond to the width of a door. Also included are a channel piece called a strike plate and matching screws.



Protruding from the upper end of the strip is a small button which, when pressed in, sends down to the floor a strip of heavy weather-proofed insulating felt that seals the door-to-floor opening, whether the floor is bare or covered with carpeting, linoleum or tile. The mechanism operating this felt is concealed.

In use, the device is easily and inconspicuously attached to the inside bottom of the door by four screws, mounted so that the bottom of the metal casing is flush with the bottom edge of the door. The strike plate is then secured to the door frame, so located as to contact the button when the door is closed.

Thus, when the door is closed, the button is pushed in, causing the felt to come down, thereby shutting out drafts completely.

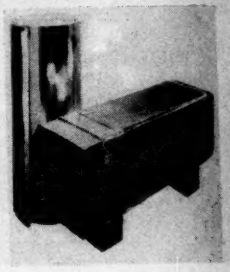
When the door is opened, the button pops out, automatically causing the felt to spring back into concealment, out of the way.

The only tool required to install the device is a screw driver. It is intended for homes, stores, hospitals, factories or wherever under-door drafts or insects are a problem. They are made to fit every standard door width and for odd sizes an adjustable model is available. Standard sizes are 28, 30, 32, 34, and 36 inches and sell for $2.95. Adjustable models, 32 to 36 inches, $3.45, 36 to 40, $3.75 and 40 to 44 inches, $3.95.

**More information? Circle Item 45 on postcard, page 127**

## Aluminum Duct Insulation

Alfol Asbestos, an aluminum foil duct wrap so compact that it is less than one-fourth the weight and one-fourth the volume of its one-full-inch mass insulation equivalent, is offered by Reflectal Corp., New York, N. Y. Consisting of ¼-inch aircell asbestos laminated to pure aluminum foil, the material insulates against heat transfer by conduction, convection and radiation.

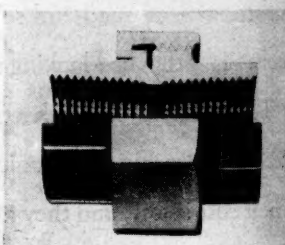


Packaged in 250 square foot rolls 36 inches wide, the insulation is rapidly cut to the required perimeter with a linoleum knife or any other handy cutting tool. Then each 3-foot length is fitted around the duct and secured with bands, wire or tape. Should a positive vapor barrier against condensation be required, the joints are sealed with aluminum pressure tape.

**More information? Circle Item 46 on postcard, page 127**

## 300 lb. Steel Seat Union

An additional integral steel seat 300 lb steam pipe union, made from seamless and forged steel, is announced by The Capitol Mfg. & Supply Co., Columbus, Ohio. This union is designed for 2,000 lb cold water, oil, or gas, non-shock, or 300 lb steam pressure.



The union has been introduced because of the demand for a steel seat union similar to the 2,000 lb brass seat union introduced last year.

The union is supplied zinc coated or in black, and is impregnated with an effective rust resistant. All unions are cartoned in convenient quantities at no extra charge.

**More information? Circle Item 47 on postcard, page 127**

# PRODUCT INFORMATION SERVICE

**Use the postage-free postcard below for further information on:**

- **News of Equipment and Materials**
- **New Catalogs**

**Circle the Item Numbers in which you are interested and print clearly your name and address with title.**

## NEW CATALOGS

**COOLING COIL BULLETIN**

A new cooling coil bulletin, No. ICCB, on its line of cooling coils for direct expansion refrigerants, circulating water and brine, is offered by Marlo Coil Co., St. Louis, Mo. This bulletin gives design, construction and dimensional data, including psychometric charts. . . **Item 48**

**REFRIGERANT PURGER**

A 4-page bulletin describing its No. 370 forged steel purger for venting air and other non-condensable gases from refrigerating systems is available from Armstrong Machine Works, Three Rivers, Mich. The bulletin describes the air problem, explains how the purger operates, and gives physical data and list price. Also included are reports from users describing benefits obtained. The purger is described as being suitable for use with all common refrigerants. . . . . **Item 49**

**CENTRAL CONTROL PANEL SYSTEMS**

An 8-page bulletin, F-5265, brought out by Barber-Colman Co., Rockford, Ill., has outlined a technique for use in designing economical automatic electric control installations for heating and air conditioning systems. Central control panel technique simplifies installation, reduces over-all costs, minimizes service, increases system flexibility, and assists engineers in preparation of specification diagrams. . . . . **Item 50**

**CIRCULAR CASE THERMOMETERS**

Catalog 6482 on recording and indicating circular case electric control industrial thermometers used for temperature control on drying ovens, cooking kettles, lumber kilns and plating tanks, is announced by the Industrial Div., Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. Information on available switching action, chart and scale ranges, dimensions and bulb and tubing variations is included. . . . . **Item 51**

**BOOKLET ON CONVECTORS**

Heating with Convector Radiators—A Guide for Home Owners is the title of booklet offered without charge by Convector Manufacturers Association, Chicago, Ill., to those building or remodeling homes. This handy size, 16-page booklet contains practical information on heating principles, with emphasis on the convectors. Written in simple, non-technical language, the booklet has numerous illustrations and photographs showing the flow of heat in various systems, parts of the convector, and actual convector installations. Selection of a heating system and the importance of heating units are discussed . . . **Item 52**

**THERMOSTATIC BIMETAL**

A 32-page booklet entitled Successful Applications of Chace Thermostatic Bimetal is available from W. M. Chace Co., Detroit, Mich. The booklet, a compact summary on thermostatic bimetal, contains eighteen uses of bimetal as the actuating element in temperature responsive devices and condensed engineering data for bimetal element design and selection. It is illustrated with various types of thermostatic devices employing thermostatic bimetal and other pertinent data. . . . . **Item 53**

**HIGH PRESSURE AIR DIFFUSERS**

Bulletin K-29, issued by W. B. Connor Engineering Corp., Danbury, Conn., illustrates and describes the company's several types of high pressure diffusers. These units are made to handle static pressures ranging from 1 to 4 inches water gage, duct velocities up to 3,000 fpm, and 25 deg. temperature differentials. . . **Item 54**

**HOW TO SELECT TUBING**

Bulletin TB-340, designed to help the tubing user in determining whether he should use hot finished, cold drawn, or "roto-rocked" seamless mechanical tubing as the basis for his product, has been issued by Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa. It outlines the differences in methods of production, surface finish, tolerances and costs of tubing finished by the three processes. . . . . **Item 55**

**MECHANICAL CHIMNEY DRAFT**

A bulletin on its draft inducers entitled Motorized Chimney Draft, Bulletin I-52, is issued by L. J. Wing Mfg. Co., Linden, N. J. Advantages of mechanical draft over natural draft in supplying positive, uniform, adequate draft, regardless of variable weather conditions or inadequate chimney or breeching construction are shown in detail as well as the advantages in eliminating the need for tall, unsightly, costly stacks. . . . . **Item 56**

**STOKER LAYOUTS**

An 8-page brochure has been issued by Canton Stoker Corp., Canton, Ohio, and devoted to its Duraflex Binfeed stoker. Blueprints show how and where the equipment should be located for greatest efficiency. Especially intended for designers where new buildings, remodeling, or conversions are contemplated. . . . . **Item 57**

**WATER PURITY METER**

Bulletin 125 which describes its new purity meter, an electronic testing device for determining the purity of either distilled or demineralized water, is issued by Barnstead Still & Sterilizer Co., Boston, Mass. . . . . **Item 58**

**LIQUID STRAINER**

A 2-page bulletin W-6 illustrating its Ideal liquid strainer is available from Golden-Anderson Valve Specialty Co., Pittsburgh, Pa. Application, parts lists, working pressures and dimensions are fully described, with a diagram showing installation arrangements. . . . . **Item 59**

**UNIT HEATERS**

A folder on its Grid unit heaters is issued by D. J. Murray Mfg. Co., Wausau, Wis. Contains reproductions of testimonial letters together with factual data, an illustration of the unit itself, features, and capacity tables. . . . . **Item 60**

**COOLING TOWERS**

An illustrated, 36 page catalog, Bulletin CT-52-4, on cooling towers has been issued by Foster Wheeler Corp., New York, N. Y. The booklet contains details of construction, charts, suggestions on recirculation, and surroundings. It also includes an inquiry data sheet for planning requirements. . . . . **Item 61**

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### AIR CONDITIONING UNITS DEFINED

Central station-cabinet type air conditioning units are illustrated and described in Bulletin 114 published by National Association of Fan Manufacturers, Inc., Detroit, Mich. The functions and purposes of four commonly accepted types of unit assemblies are graphically presented by means of chart drawings and tabular matter. The engineer will find the check list of functional elements helpful in the Preparation of specifications. . . **Item 62**

### PIPING LABELS

Use of pressure-sensitive self-adhering printed identification for cable, conduit, and pipe is described in a folder issued by Westline Products Wiv., Western Lithograph Co., Los Angeles, Calif. . . **Item 63**

### DATA ON FABRICATED FITTINGS

As a practical help in planning piping and equipment layouts, Naylor Pipe Co., Chicago, Ill., announces a new bulletin, No. 525, on standard and special fabricated fittings. Data include specifications and prints on standard fittings for lightweight pipe. It also presents illustrations of special fabrications designed to save time and labor and reduce material costs in modernizing piping systems. . . **Item 64**

### PACKAGED AIR CONDITIONERS

A specification sheet describing two packaged air conditioning ssytems, one of 10 and one of 15.5 tons capacity, is published by Worthington Corp., Harrison, N. J. Cooling, dehumidification, ventilation, circulation, cleaning, and heating if desired, are provided by the packaged systems in five sizes. The size range permits unit selection in balance with encountered loads. . . . . **Item 65**

### PERIMETER HEATING

A comprehensive description of the company's Save-Way air system of perimeter warm air heating using 4-inch duct work is available from Surface Combustion Corp., Toledo, Ohio. . . . . **Item 66**

### GAS BURNERS

A 6-page bulletin, 52-L-1, in color has been issued by The Sonner Burner Co., Winfield, Kan., to describe its line of gas conversion burners, specifically the L-52 series, a new line which supersedes the L-1 and L-2 burners described in previous catalogs. . . . . **Item 67**

### WATER TREATMENT CELLS

A 4-page folder has been issued by Electromatic Water Treatment, Inc., New York, N. Y., describing its units for prevention of scale and corrosion in boilers and hot water systems. The units are galvanic cells which generate electricity when submerged in water. This causes scale to precipitate. Cells are expendable. **Item 68**

### BURNER SERVICE GUIDE

A convenient pocket size guide giving 113 causes and 113 remedies for 20 of the most common gun type oil burner service problems is issued by Green Colonial Furnace Co., Des Moines, Iowa. The guide is printed on heavy card stock and on the left hand side of the front and back cover are listed the 20 problems. By moving an arrow on the inside card of the form, the various causes and remedies automatically appear. The service guide is available at $1 each. . . . . **Item 69**

### VENTILATOR SELECTOR

To enable contractors, building engineers, or others to quickly and easily choose the right type and capacity of standard vent set equipment for his particular application and requirement, Bayley Blower Co., Milwaukee, has developed a completely new and different style of capacity table set-up. In place of requiring a large number of pages to cover all the units and capacities in the line, all the essential figures have been condensed into a single wide-spread tabulation that can be seen at a glance. . . . . **Item 70**

### THERMOMETER CATALOG

A new two-color thermometer specifications catalog G-158, has been prepared by The Electric Auto-Lite Co., Toledo, Ohio. The eight-page catalog describes the complete line of Auto-Lite recording thermometers and gages as well as dial indicating thermometers. Applications, chart ranges, dial ranges and accessories are listed in the booklet, with blue-print illustrations to show the varied types of installations. Instructions for ordering also are included. . . . . **Item 71**

### DUST COLLECTION

Dust Collection in the Manufacture of Agricultural Chemicals is the subject of Bulletin 342 published by American Wheelabrator & Equipment Corp., Mishawaka, Ind. This bulletin shows how Dustube cloth-tube-type collectors are being used for improving working conditions and recovering valuable material which would otherwise be lost to the atmosphere. Typical examples of companies who manufacture fertilizer, sulphur, cryolite, benzene hexachloride, and DDT are shown in this 4-page bulletin. . . . . **Item 72**

### ELECTRONIC COOLING FANS

Axivane fans for cooling air-borne or ground-located electronic equipment are discussed in Bulletin J-612 available from Joy Mfg. Co., Pittsburgh, Pa. The bulletin includes specifications on vaneaxial type fans with diameters from 2 to 14 inches; capacities from 20 to 4400 cfm; weights from 10 ounces to 52 pounds; and horsepower from 1/500 to 12 hp. Described fans are designed to meet such requirements as: spot cooling of local high-temperature conditions; heat removal from restricted space; and heat removal from pressurized or hermetically sealed units. Built of cast aluminum or magnesium for light weight, the fans are said to operate effectively at high altitudes and at temperatures as low as —100 deg. **Item 73**

### FREE DRAFTING AID

A useful device is offered free on request by Unistrut Products Co., Chicago, Ill. Called the Circ-L-Scale, and approved by the American Society of Industrial Engineers, it is a combination compass, scale, square, protractor and lettering guide. It is small, handy and durable, and made of vinylite because of the low coefficient of expansion. On the reverse side are temperature conversion table, decimal equivalents, tap and drill scale, and a metric rule. . . . . **Item 74**

### DUCT FAN CATALOG

A revised edition of its catalog on Bifurcator fans, DB-4-52, is issued by DeBothezat Fans Div., American Machine and Metals, Inc., East Moline, Ill. Specifically designed for exhausting fumes or gases which are abnormally hot, flammable or explosive, this fan is a direct-motor driven fan in divided housing, with the motor mounted in a separate chamber isolated from destructive gases. Catalog is profusely illustrated and contains specifications, dimensions and certified capacities of fans ranging from 12 through 48 inches in diameter and handling up to 45,000 cfm. . . . . **Item 75**

### UNIT HEATER CATALOG

A new catalog, No. 1209, presenting a line of propeller fan unit heaters is issued by Airtherm Mfg. Co., St. Louis, Mo. The 16 pages of description, photos, applications and specifications cover both horizontal and vertical units. Diagrams show ideal arrangements for getting the most efficiency from unit heaters for areas of various shapes. Tables and charts show capacities of various models. . . **Item 76**

### EXPANSION JOINT BULLETIN

An illustrated bulletin describing its line of expansion joints is available from Flexonics Corp., formerly Chicago Metal Hose Corp., Maywood, Ill. Recent design changes have produced improved expansion joints capable of accommodating increased expansion with fewer corrugations. The new bulletin gives complete specifications and installation data for Flexon-type free-flexing joints for low pressure applications, controlled-flexing joints for high pressure installations, and Flexoniflex joints for the handling of extremely high pressures. . . . . **Item 77**

### BACKING RING STANDARDS

Publication of a standards bulletin having the title End Preparation and Internal Machining for Machined Backing Rings for Butt Welds is announced by The Pipe Fabrication Institute, Pittsburgh, Pa. Designated as Standard ES1-1952, it supersedes the first standards bulletin issued almost four years ago. This revised standard meets present-day high pressure and high temperature piping requirements; it includes design changes that minimize the amount of weld metal required and the shrinkage stresses in the weld. . . **Item 78**

**PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.**

| | | | | | | | | | |
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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
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Sept. H-52

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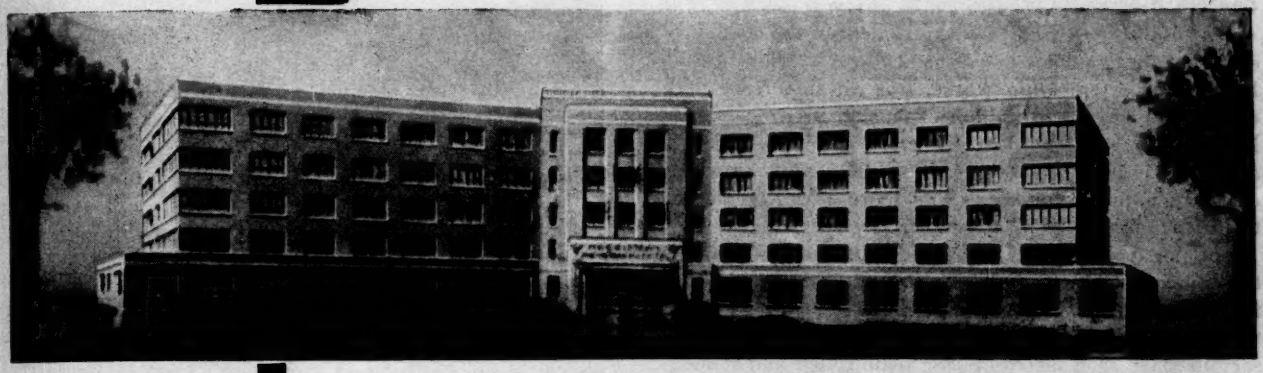
# HEATING SYSTEM

### *CONTINUOUS FLOW CONTROL*
### TYPE A



**MORRISTOWN (N. J.) MEMORIAL HOSPITAL**
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Series 48 Supply Valve

Series G Thermo Trap

Type A Valve

Enthusiastic teamwork and compact planning produced this masterpiece of building economy—a new 236-bed general hospital to serve 5 counties in Northwest New Jersey. It represents the "most beds per dollar" with direct construction costs 20% less than national average.

In keeping with this economical planning, a Type A ILLINOIS Control System was selected to represent maximum value. Although higher in first cost, its operation will reflect a sound economy year after year as well as giving the comfort and convenience of automatic heat perfectly controlled.

Three oil-fired boilers generate steam at 105 psig. for the laundry equipment. A 50 psig. system serves the kitchen, sterilizers and autoclaves. Another reduction to 10 psig. handles the air conditioning and ventilating coils, hot water generators and unit heaters. Finally, in three independently controlled zones, steam is reduced by Illinois Continuous Flow Type A valves to pressures varying from 1 lb. to 24 inches (Hg.) vacuum. Outdoor thermostats, in combination with vacuum pump controllers automatically govern the flow and temperature of steam to the standing cast iron radiators, producing a continuous output varied to meet weather demands.

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# NEWS OF THE MONTH

## HUGE PRESS

**forms boiler drum section from heaviest steel plate ever rolled. Helps new draw bench to make forged vessels.**

Installation of the nation's largest press for forming boiler drum plate and the introduction into America of a method of forming heavy-wall hollow forgings by piercing and drawing an ingot, have been announced by The Babcock & Wilcox Co.

• **EXPANSION.**—Alfred Iddles, president of the company, said that the mammoth equipment, now in operation at B&W's Barberton, Ohio works, was an important part of the company's $30 million expansion program which has been in progress since the close of World War II and is geared to meet the needs of the rapidly growing electrical industry for larger and more powerful boilers to produce more steam for power.

The new press and draw bench, built and installed by the company at Barberton, will produce a rough hollow forging up to 35 inches outside diameter with 4½-inch walls, in a matter of minutes. Until now it has been necessary to make such pieces of steel plate rolled and welded at the seam or from a solid forging with the center bored out. These forgings are used mainly for boiler parts and connecting steam lines operating at high temperature and pressure as is the trend today.

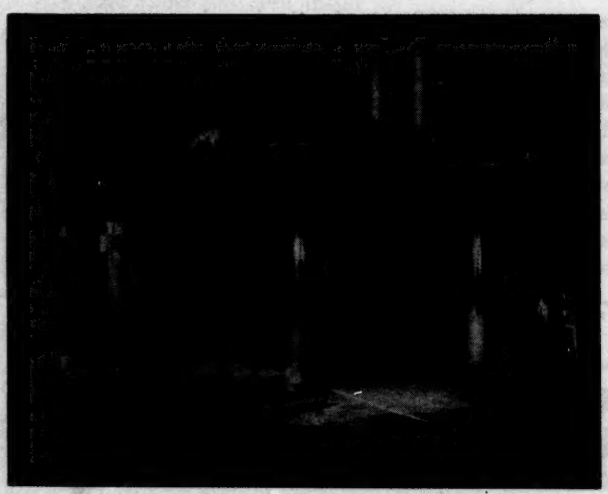
• **DRUM PLATE.**—The vertical press has a normal capacity of 6,500 tons or an itensified capacity of 8,500 tons. It is equipped with massive bending beams 42 ft long and its open-ended design makes it possible to bend even longer plates. It is 64 ft overall height from the bottom of the pit in which it stands. As a steam drum is composed of cylinders made from plate, the announcement said, a longer plate means that there will be fewer circumferential welds, with a subsequent saving in time and cost.

Draw bench forces long mandrel into pierced ingot while ring die holds outside dimension of hollow forging.

• **PRESS.**—The four supporting columns for the press are giant steel pillars 52 ft high and 26 inches in diameter, each weighing 41 tons. The largest of the three press platens weighs 200 tons.

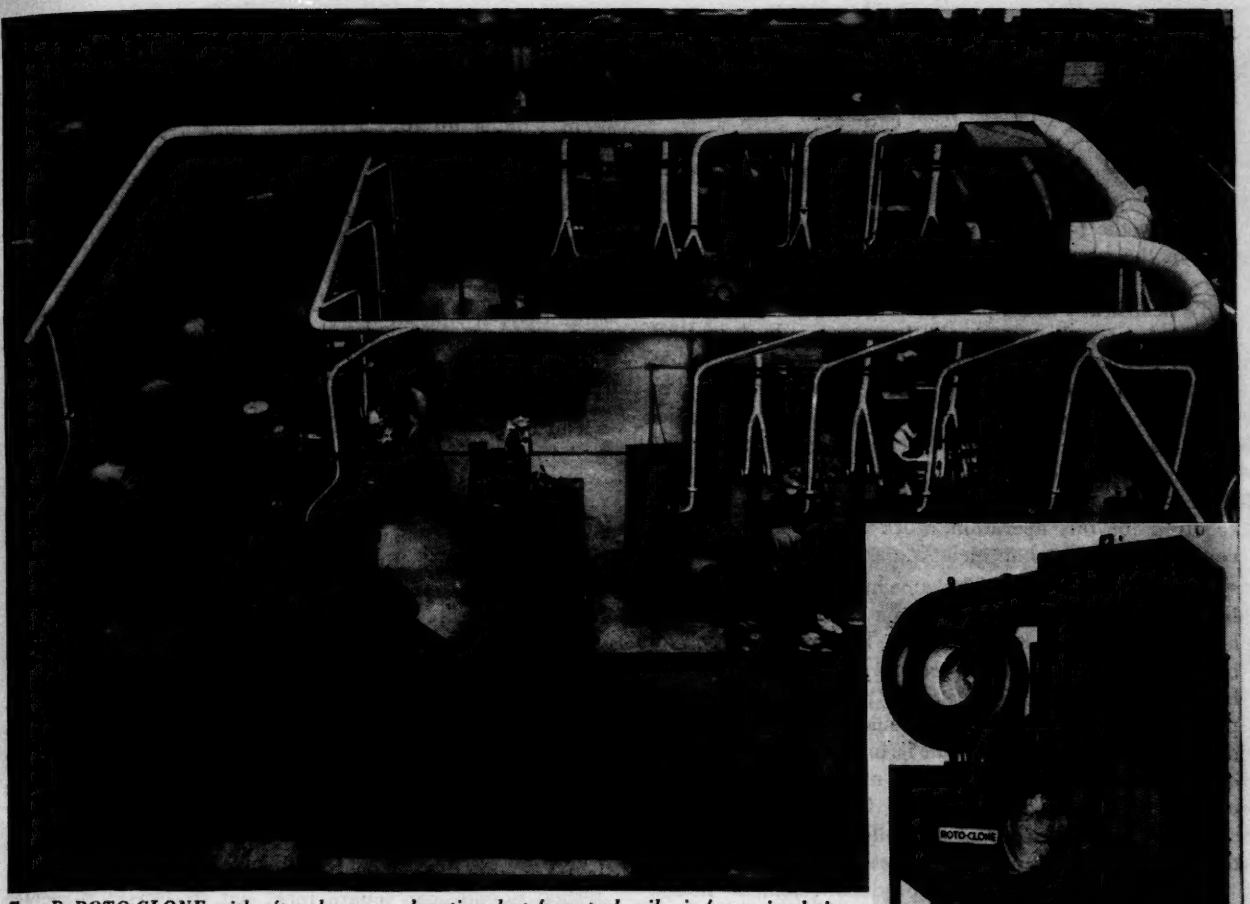
The press and draw bench were built of heavy welded steel plate, and are housed in a new shop building 105 by 275 ft and 92 ft high, designed especially for this extension of facilities on the plant site. A complete hydropneumatic pressure system to operate the equipment was installed at the Barberton plant. The seven water and air

(*Continued on page* 130)



Press with underslung bending beam forming half cylinder from 6-inch steel plate. Chain curtain on beam diffuses radiant heat from glowing plate. Positioning hook is on post, left.

Pressure vessels contain water and air to operate press, draw bench and four positioning hooks used in holding steel plate for bending. Vessels were made by B & W.



*Type D ROTO-CLONE with after-cleaners exhausting dust from tool crib air for recirculation*

*Type D ROTO-CLONE with after-cleaners.*

# **CLEAN AIR** from a tool crib ... bird's eye view

***Compact AAF ROTO-CLONE Eliminates Dust From Multiple Grinding, Buffing Sources.***

Dust dispersion from tool refinishing is no longer a problem for this aircraft manufacturer. Note that a compact and efficient Type D ROTO-CLONE installation with after-cleaners allowed a tool crib location in the very heart of the plant . . . easily accessible to all operations. Dust and dirt were so successfully eliminated from multiple grinding and buffing sources that only low partitions were required and air could be freely recirculated to other work areas.

AAF's Type D ROTO-CLONE is a dynamic dust precipitator which combines the three functions of exhausting, separating and storing dust in one compact, self-contained unit. Widely used in the metal working industries the Type D delivers collection efficiencies between 95 and 98%. However, where it is desirable to recirculate air to work areas, the air leaving the ROTO-CLONE may be passed through an after-cleaner to remove remaining fines. The Type D's compact design is a highly desirable and exclusive feature. It permits location near the dust source, allows dust producing operations to be placed at the most advantageous positions, and permits easy relocation.

Whether your dust problems concern tool refinishing or other metal working operations, obtain full information on the Type D ROTO-CLONE. AAF representatives are as near as your phone . . . in all major cities . . . or write to us for Engineering Bulletin No. 270-E1.

**AAF American Air Filter**
COMPANY, INC.
294 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q. • Pacific Division Office, San Francisco, Cal.

## HUGE PRESS

(*Continued from page* 128)

accumulators were designed, fabricated and installed by the Barberton works.

During the past month the press formed into a drum section the heaviest steel plate ever rolled. It was produced by Lukens Steel Co. of Coatesville, Pa.

To heat heavy drum plate as well as ingots for forging before shaping them, a special furnace was built of B&W firebrick, insulating firebrick and refractory castables made by the company in its Refractories Division plant at Augusta, Ga. It is 14 by 50 ft and 7 ft high, inside dimensions. An additional furnace for reheating hollow forgings is in the process of installation. Furthermore, to insure an adequate supply of the special analysis ingots required for this operation, work has begun on a self-contained melting shop including a new arc furnace.

• **HOLLOW FORGINGS.**—The same huge press used to form heavy plate, is also used to pierce or force an opening, lengthwise, into a heated ingot. The hollow ingot, or bloom, is then taken to the second piece of equipment, a horizontal draw bench (largest in America for this purpose). It is then fitted over a mandrel to hold inside dimensions and the hot bloom is forced through a series of ring dies by the head of the mandrel, reducing the outside diameter and increasing its length, to proper size. The result is a seamless, hollow forging of predetermined inside and outside diameter.

The new equipment will produce seamless hollow forgings from a minimum of 8 inches inside diameter and ¾-inch wall thickness up to a maximum inside diameter of 26 inches and a wall thickness of 4½-inches in lengths up to 22 ft. The maximum weight of the cropped ingot which the equipment can handle—26,000 pounds—controls the maximum final size of the forging which may be 14 to 15 ft in length for heavy wall thickness and large diameters, and up to 22 ft in length for lighter wall forgings.

As the special tooling for this process can be changed quickly, it was explained, it is possible to produce one or two lengths of a particular size or of a specially desired specification of steel at very little unit cost per forging for the change-over. Both alloy and carbon steels can be successfully used in the process.

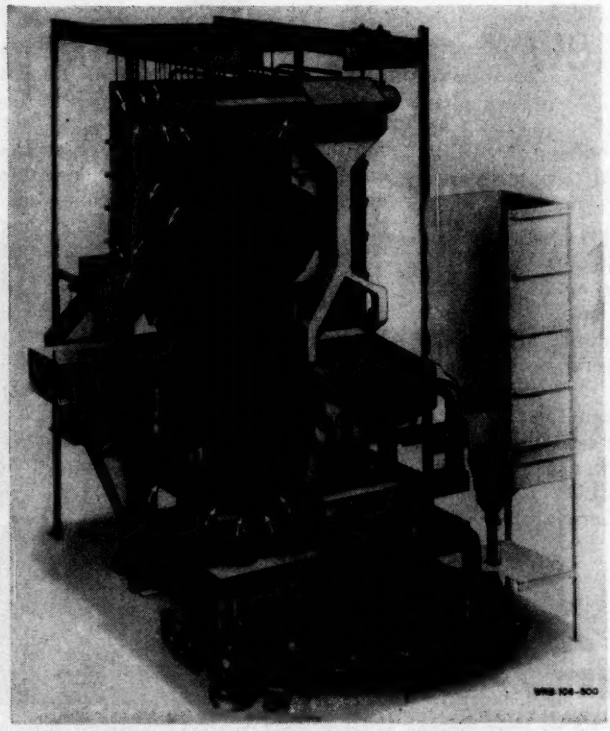
In addition to the piercing of ingots and forming of heavy drum plate, the large vertical press can be readily converted to the forming of heavy pressure vessel heads, warped sections and other general purpose press work.

Special fabrication operations such as upsetting, reducing, expanding and cold drawing can also be performed on this equipment when required.

• **TREND.**—Together with a rapid rise in demand from utilities following World War II came a rapid rise in another aspect of the power boiler story—the quickening of the trend toward boilers of higher temperatures and higher pressures, Mr. Iddles said, explaining that the higher the temperature and pressure of steam, the more kilowatts it will produce per pound.

In 1946, B&W's average utility boiler produced steam at a temperature of about 900F and a pressure of about 1300 pounds per square inch, but in 1951 the average boiler called for temperatures of 1000F and pressures of 1900 pounds per square inch. These are averages. Top B&W units today call for temperatures of 1050F and pressures of 2300 pounds per square inch, and we are working toward even higher figures, Mr. Iddles said.

These new demands mean that drums have to be heavier, tubes of better alloys, refractories more stable, and almost every part of a boiler has to be "better" in some way than those of a few years ago.



Cutaway of boiler. Arrows point to vessels formed on draw bench and press.

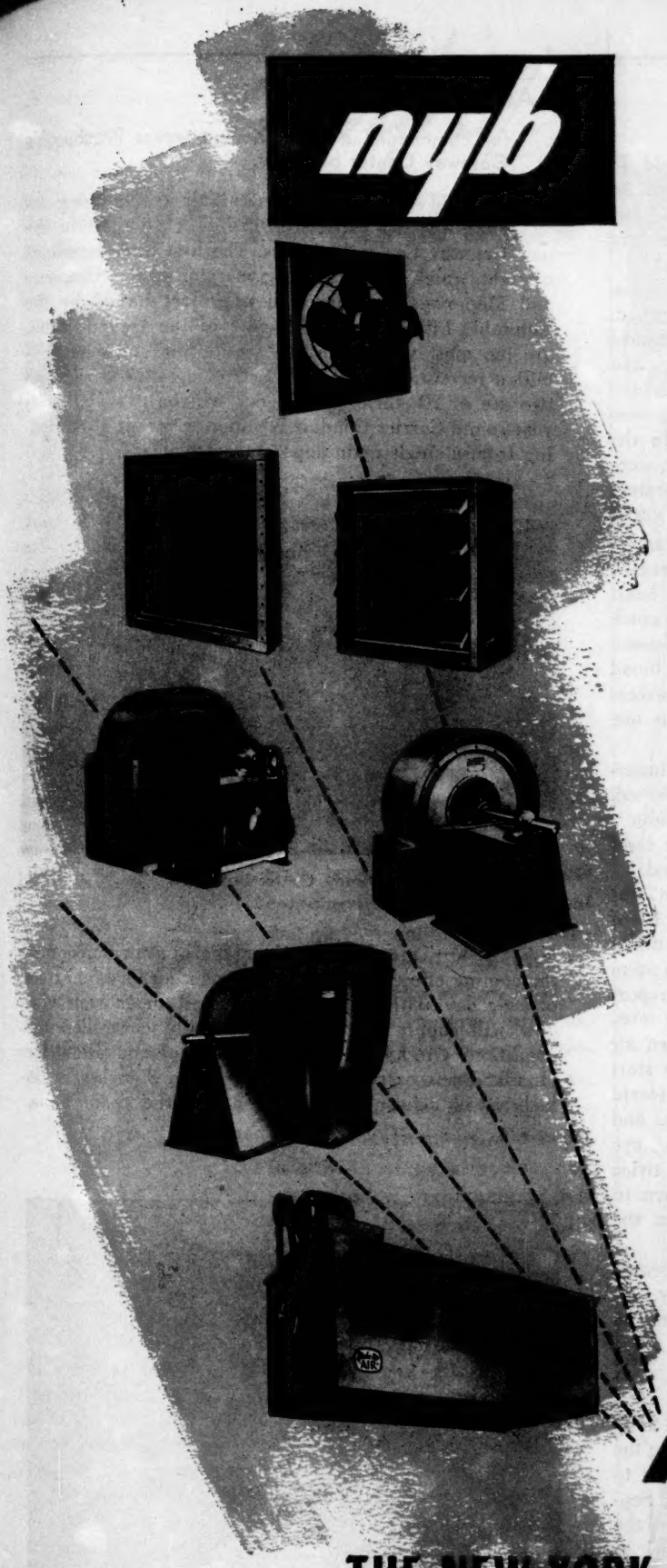
## HEART DISEASE

**may be aggravated by high temperatures, doctors reveal in air conditioning research study.**

Constant living in high temperatures can actually cause a heart attack in a person with a weak heart and can cause complete collapse in those actually suffering from chronic heart disease, according to a report to the Mitchell Air Conditioning Research Foundation by the Medical Research Institute of the Michael Reese hospital, Chicago. Air conditioning in hot weather can have an equal effect in combating such attacks, the report indicated.

• **GRANT.**—The report was the first project in a program of studies conducted by Dr. Louis Katz and associates in accordance with a grant made to the hospital by

(*Continued on page* 132)



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**BUILT TO MEET MODERN INDUSTRIAL REQUIREMENTS**

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**UP TO 150 POUNDS STEAM PRESSURE**

The rugged arc welded construction outperforms and outlasts heating elements made of thinner non-ferrous metals, avoids their expansion-contraction faults, yet has the same BTU efficiency.

Originated in 1922, it has an enviable record of dependable performance.

***Write for copy of Bulletin 514, also 492 which gives engineering details.***

**FANS • BLOWERS • UNIT HEATERS • MAKE-UP AIR UNITS • HEAVY DUTY HEAT SURFACE**

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## THE NEW YORK BLOWER COMPANY

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**FACTORY, LAPORTE, INDIANA**

## HEART DISEASE

(*Continued from page* 130)

the Mitchell Foundation. According to Dr. Gerald R. Graham, senior associate of Dr. Katz and author of the report, the purpose of the project was to gather all significant data on the effect of hot weather on healthy people and those with heart disease.

The report combined and evaluated experiments conducted over a period of more than 30 years, Dr. Graham indicated. The experiments were conducted in almost every situation where men have been forced to work and live in hot climates. Among these were studies conducted during desert battles in World War II, and during construction projects in the American desert and in the tropics. Many of the most valuable studies, however, were conducted under strict clinical conditions with volunteer subjects, stated Bernard A. Mitchell, founder of the grant.

• **HEAT EFFECT.**—First effect of heat on the human body, Dr. Graham wrote, is an enormously increased heart rate. He cited several studies in which the heart rate in normal, healthy subjects was increased by as much as 43%. Another effect is a serious drop in blood pressure caused by dilation or expansion of the surface blood vessels in an attempt by the body to carry off the excess heat. Loss of blood supply to the internal organs is one result of this effect, the report stated.

This means that the main effect of heat is an immediate decrease in physical efficiency, it was explained. Merely moving about in a temperature of 95F produces as much strain on the heart as heavy labor under ordinary or comfortable conditions, the report indicated.

Combined evidence of Dr. Graham's statement was contained in a recent study in which 25 persons, 12 of whom suffered from a heart ailment, were tested under laboratory conditions. The subjects were placed in a room in which the temperature was raised to 104F, the report said. Those suffering from heart disease showed immediate signs of collapse and had to be removed to an air conditioned atmosphere within 40 minutes of the start of the test. The normal subjects were left in the torrid atmosphere for 114 minutes, Dr. Graham wrote, and were removed when they showed signs of weakness, eye failure, faintness, and headaches. It took nearly twice as long as the test lasted for the subjects to return to normal after they were taken from the heated room, the report stated.

Marked fluctuations in conditions, particularly repeated or prolonged increases in temperature or humidity, are as harmful as excessive physical activity and should be carefully guarded against, Dr. Graham concluded.

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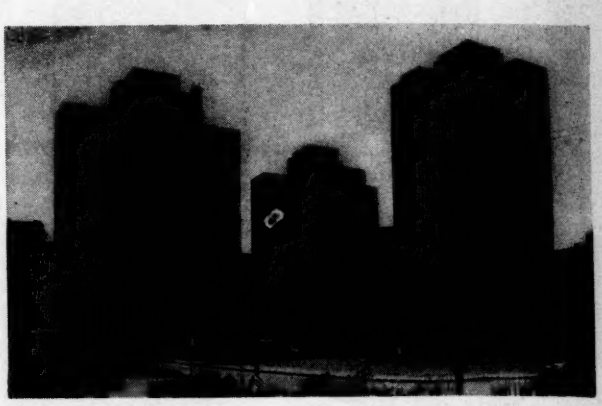
• The Instrument Society of America will mail out 250,000 invitations and preliminary programs announcing the Seventh National Instrument Conference and Exhibit to be held in the Public Auditorium, Cleveland, Ohio, September 8-12, 1952. This gathering, sponsored by the Instrument Society of America, will include the American Institute of Physics, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Institute of Radio Engineers, the Cleveland Physics Society and the Scientific Apparatus Makers Association.

## LARGEST SYSTEM

**for commercial air conditioning serves Pittsburgh's Gateway Center buildings.**

The world's largest commercial air conditioning installation was dedicated in Pittsburgh July 30 in the new Gateway Center buildings. The first three buildings of eight, which will arise at the merging of the Allegheny and Mononogahela Rivers in a project owned by the Equitable Life Assurance Society of the United States, are the most visible part of Pittsburgh's current $1½ billion reconstruction program. One is of 24 stories and two are of 20 stories each. They will be provided with year-round Carrier Conduit Weathermaster air conditioning from a single main apparatus room.



Gateway Center buildings.

• **SYSTEM.**—Three big centrifugal machines will generate the cooling effect produced by the melting of 4,500 tons of ice a day. 6,013 room units mounted under each window will supply automatic individually controlled air conditioning to all offices. Fifteen miles of small-diameter circular ducts or conduits ranging from 3 inches to 36 inches will deliver conditioned air to the room units.

(*Continued on page* 134)

Water cooling and circulating machinery.

# Alnor Velometer

**gives instant, direct reading of Air Velocity . . . Anywhere!**

**Here is a precision-built, self-contained, portable instrument that gives instant, accurate reading of air velocities—anywhere. Measures speed of flow through ducts, grilles, motors, furnaces, etc., or in the open. Needs no calculations or reference charts. Anyone can use it and get accurate measurements. Available in a wide range of scales, and with a wide assortment of jets and fittings if needed. You'll want full details and prices, so write for Bulletin No. 2448-G. Illinois Testing Laboratories, Inc., Room 514, 420 N. La Salle Street, Chicago 10, Ill.**

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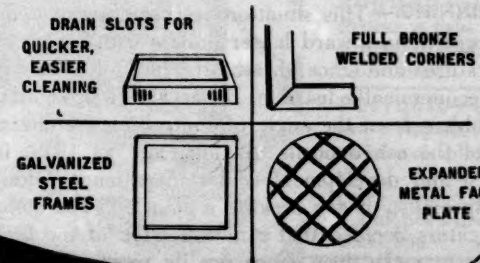
PRECISION INSTRUMENTS FOR EVERY INDUSTRY

# Airsan EXTRA FEATURES

*mean more effective dust collection*

Airsan Air Filters offer you extra features that save you money, offer greater filtering efficiency. Initial cost and installation is less. Easier cleaning and larger dust-holding capacity cuts maintenance expense. Approved by Underwriters' Laboratories. Investigate Airsan today. Learn why it pays to *buy the difference* — at no extra cost.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EXPANDED METAL FACE PLATE

## Air Filter Corporation

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Canadian Representative

DOUGLAS ENGINEERING CO., LTD., MONTREAL

*A few Distributorships Available. Write for Detail*

Name "AIRSAN" is Reg. U. S. Pat. Off.

## LARGEST SYSTEM

(*Continued from page* 132)

Seventy-two miles of piping will provide chilled or warm water for the Weathermaster units to permit individual control of temperature in the space. Weathermaster units will contain a total of 12 miles of coils for this purpose.

• **CIRCULATION.**—Twelve high pressure fans ranging from 6 to 6¼ ft in diameter and 18 fans of 5½ to 8½ ft in diameter will circulate a total of 753,000 cubic feet of air through the air conditioning system every minute. A total of 930 horsepower is required to circulate this amount of air.

• **CHILLED WATER.**—Centrifugal pumps will circulate a total of 7,500 gallons of chilled water a minute through the room units and the central station air conditioning equipment. The cooling, dehumidifying, and heating coils in 30 sets of central station air conditioning apparatus will total 17 miles in length, and present 68,000 square ft of coil surface.

Electrostatic filters will remove dust and dirt from the air before it enters the air conditioning system.

---

## BOILER SLAGGING

**relieved by new oil additive developed to change character of tube deposit for easy cleaning.**

Significant results in relieving the problem of troublesome deposits on boiler tubes from the firing of residual fuel oil have been accomplished in both laboratory and field operations according to The Babcock & Wilcox Co., designers and manufacturers of steam generating equipment. Certain grades of oil such as Bunker C have long been recognized as having the disadvantage of containing ash contents, which, upon combustion, result in depositing on boiler heat transfer surfaces, particularly superheater tubes, a hard residue not readily removable by air or water lancing. Frequent interruptions in operation were required for thorough cleaning.

• **BEGINNING.**—This situation has been aggravated with the recent trend toward larger boilers with higher steam temperatures and since an ash free fuel oil of this grade is not economically feasible, Babcock & Wilcox attacked the problem from the angle of controlling the characteristics of the ash deposits. As long ago as 1949, in its research and development center in Alliance, Ohio, the B&W specialists began seeking a solution. The company investigators decided that a modification of the fuel ash deposits to make them more readily removable was the best approach.

• **FUSION.**—Troublesome superheater deposits were found to be characterized by low-melting constituents and laboratory work was carried out on selected materials that, when intimately mixed with the oil ash, would raise its melting point so that upon deposition on heating surface it would be dry and thus more readily removable by the customary means on an operating unit. The effect on fusing temperatures by intimately mixing synthetic oil ash with various additive compounds was studied using ASTM coal ash fusibility determinations. The first fusion cones were made from an actual oil ash obtained by burning a quantity of a typical troublesome oil until the ash was left as a residue. Since this was a tedious process and an expensive way to obtain oil ash, all subsequent samples were compounded by mixing the individual constituents in proper proportion to obtain the same chemical composition as present in the oil ash. Comparable fusing temperatures were obtained when using this synthetic ash. A number of materials were added individually to the synthetic ash and it was found that some mixtures had higher fusing temperatures than the oil ash alone.

• **PILOT.**—The next step in the investigation was to set up a pilot furnace for testing promising additives under simulated operating conditions. The equipment, as constructed at the B&W research center, consisted essentially of a small furnace in which the fuel-additive mixture was burned and a series of three air-cooled coils upon which the resulting deposits from the products of combustion were collected. The coils were placed at different levels in the stack to study the effect of various temperature zones on deposit formation on the cooled metal tubes.

During the pilot tests the additive was mixed with the fuel prior to combustion, as it was believed that the effectiveness of the additive would thereby be increased due to its more even dispersion through the fuel and its more intimate contact with the oil ash throughout the combustion process. For this reason a mixing device was incorporated in the test arrangement.

To accelerate the tests and increase the rate of deposit formation, diesel fuel oil to which a synthetic ash was added was used to produce deposits similar to those obtained on commercial units.

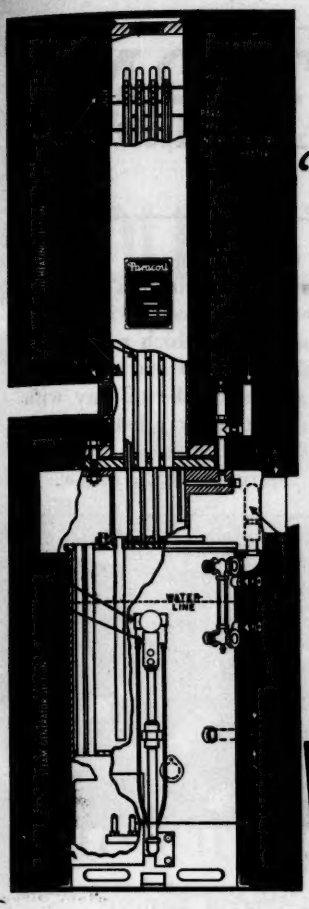
Additives in the form of finely divided materials suspended in the fuel and metallic organic compounds of the soap type (soluble or miscible with oil) were tried in the pilot-plant tests in various weight ratios to the ash in the oil. Alumina, magnesium oxide and calcium oxide were found to be the most promising of the additives tested in producing a powdery deposit that was easily removable from the coils. This contrasted with the hard, glassy, fused material that was formed when these additives were not used.

Aluminum stearate proved to be very effective, but economic considerations make its practical use doubtful. Finely divided alumina is commercially available at a cost of about 3.25 cents per pound in bulk and, when suspended in the fuel in a ratio of one pound of additive to one pound of ash solids, it appeared to be sufficiently practical and economically feasible to justify large scale trial.

• **FIELD TESTS.**—Accordingly, about a year ago arrangements were made for a test program on a commercial-size unit under actual operating conditions at the Inglis station of the Florida Power Corporation.

The unit is an FH boiler having a capacity of 300,000 lb/hr steam at 900 psi and 910F total steam temperature, equipped with an inverted-loop superheater. It carries a

(*Continued on page* 146)



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**A COMPLETE SOLUTION TO THE OIL-IN-BOILER PROBLEM!**

**As the Type "GF" Heater is in no way connected to the steam or water space of any boiler it may be serving, there can be no possible contamination of the boiler heating surfaces in the event of an oil leak in the heater.**

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Completely factory assembled • Easy to install anywhere, even outdoors • Requires only minimum of floor space • Economical to operate • Wide range of oil heating capacities • Burns any specified type of gas fuel High oil temperatures at all times • Operation unaffected by normal variation in viscosities of oils being heated • Reduces oil consumption through improved fuel combustion.

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- Low temperature forced hot water heating systems on No. 6 oil.
- Plants with starting difficulties after week end shutdowns.
- Supplementing inadequacies in present oil preheating systems.

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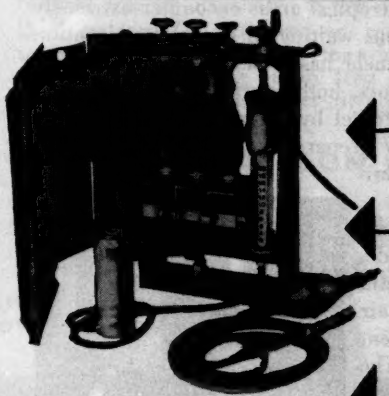

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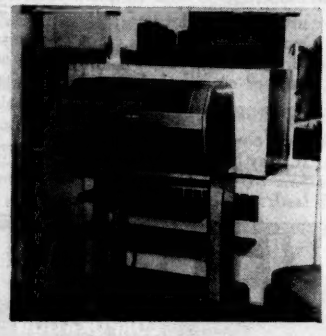
# PRODUCT APPLICATIONS

## New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

### Window Units Installed Without Overhang

**PROBLEM:** In many apartment buildings, landlords prohibit the use of any type air conditioner which protrudes past the side of the building. A typical example is in a new apartment building at 1350 Lake Shore Drive, Chicago. In this particular instance, the problem was complicated by the use of casement type metal windows coupled with a house rule that nothing could be placed outside the building. A radiator beneath the window further complicated matters.

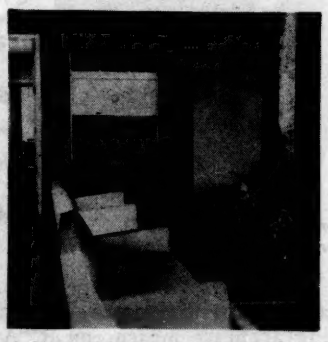


**SOLUTION:** A new installation method has been developed by the Mitchell Manufacturing Co., Chicago. The device consists of limed oak stand which houses the entire window unit allowing the section normally placed outside the window to be placed in the room with provisions for discharging heat outside the window.

**RESULTS:** Four advantages of the installation have been reported: (1) Building rules are followed exactly; (2) Cost of the installation was 50% less than the cost of a console unit; (3) The installation formed an attractive piece of furniture adding shelf space to the room; (4) The radiator was free to operate without obstruction.

### Immigration Department Air Conditioned

**PROBLEM:** Travelers in tropical areas encounter extremely uncomfortable conditions waiting in line at immigration offices. Recently Venezuela has experienced an increase in the number of visitors, both tourist and commercial. Most of these visitors travel by air and some attempt to travel with improperly prepared papers which slow up the processing at immigration centers.

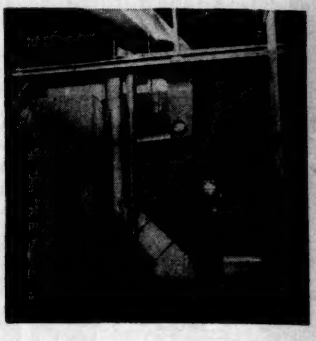


**SOLUTION:** At the air terminal immigration department at the Maiquetia Airport, 31 tons of air conditioning equipment have been installed. The equipment consists of two 8-ton and three 5-ton Chrysler Airtemp packaged units. These units were installed without duct work.

**RESULTS:** Visitors to the air terminal have been pleased with local management for their consideration of the travelers' comfort. This is the first air conditioned immigration department in South America. Free blowing installation was accomplished at minimum cost.

### Heaters Used in Ceramic Drying

**PROBLEM:** At the Parkersburg, West Virginia plant of Porcelain Products, Inc., electrical porcelain insulators are manufactured by a wet process in which a slip mixture of water, ball clay, china clay, flint and other materials is mixed to produce a plastic cake of clay with uniform moisture content. This is then kneaded in a mill into a solid mass and extruded so it can be cut into sections suitable for forming operations which follow. In forming the clay is placed in a plaster-of-paris mold and inserted in a hydraulic press where it is shaped. The next step in production is to shrink the clay body inside the mold so it can be removed. The company had reported distortion of pieces by poor distribution of heat, uneven drying of molds, and lack of adequate temperature control.



**SOLUTION:** Ducts for driers were connected to a single direct fired Dravo counterflow heater which supplies heated air at high velocity. Molds containing the pressed ware are placed on a continuously operated conveyor belt traveling through the drier. In the drier, molds pass under a metal hood containing nozzles through which heated air is emitted at high velocity in a definite pattern.

**RESULTS:** Besides eliminating all of the disadvantages of the old driers, the new system reduces mold release time about ⅔, and permits closer quality control. Previously, molds had to be stored in the open to dry for as long as two days. New molds can be reused quickly and inventory of molds is reduced to a minimum. The first system installed was so successful that the company is installing a second drier of approximately the same size. The same Dravo heater, with an output of 1,000,000 Btu per hr was connected to the second drier and now serves both.

### Insulation Stops Condensation in Filters

**PROBLEM:** An eastern cement manufacturer found that moisture condensed during cold months and caused clogging of filter bags. This required their frequent replacement.

**SOLUTION:** The cement company's engineering department decided to insulate the collectors. They chose Ultralite, produced by Gustin-Bacon Mfg. Co., a glass fiber insulation supplied in long rolls of various width for fitting irregular surfaces. The insulation is held in place on the collectors with an adhesive, covered with chicken wire and a troweled-on mastic which acts as a vapor barrier.

**RESULTS:** Condensation in dust collectors during cold weather was effectively prevented.

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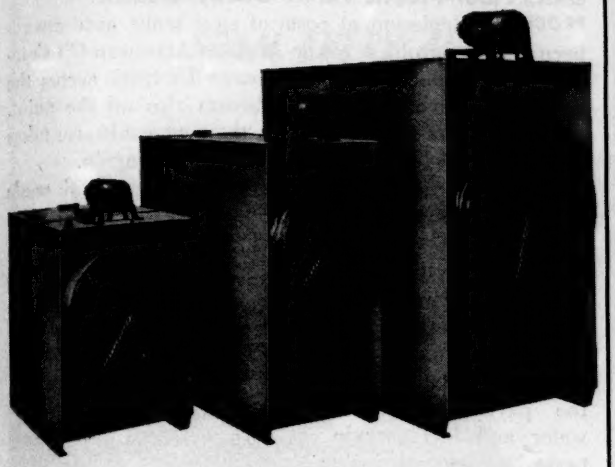
# COOLING TOWERS



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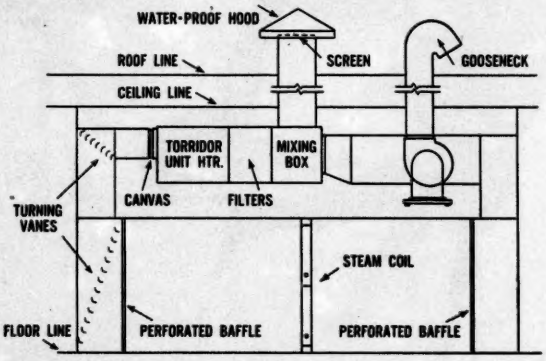
## Unit Heaters Cut Pigment Drying Time

**PROBLEM:** At the Pittsburgh Paint Co.'s Milwaukee plant, one of the production bottlenecks was a 48-hour drying time required to make pigments ready for use.

**SOLUTION:** Company engineers designed new ovens using Trane Torridors, blower type unit heaters manufactured by the Trane Company, La Crosse, Wis. In the new ovens, outside air is drawn through the heater and circulated in controlled volumes with some recirculated room air.




The mixture is filtered and introduced into the drying oven through a perforated distributing plate. A Trane steam heating coil, placed midway in the oven, reheats the air so that drying is uniform throughout. Centrifugal fans maintain constant circulation of heated air, and an exhaust fan maintains proper pressure in the oven room.

**RESULTS:** Drying time is kept to 23 hours. Ovens provide a closely controlled rapid drying process.

## Air Cooled Animal Rooms Aid Research

**PROBLEM:** Variations in temperature, humidity and dust content in the air of rooms housing experimental animals have been found to obscure the direct results of experiments performed on the animals.

**SOLUTION:** Three different types of conditioning equipment have been installed in research projects of the Veterans Administration Hospital in Syracuse, an experimental rat room in Bellevue Medical Center in New York, and in two animal inoculating rooms in the Grayson Foundation Laboratory of the University of Maryland. The V. A. Hospital animal wing contains three rooms, including operating and feeding rooms. Specifications call for summer cooling and winter heating by a completely self-contained air conditioning plant. The equipment, supplying 100% fresh air, must provide at least four tons of cooling, heating from —10 to 80F, and must deliver 850 cfm against ½ inch static pressure. These specifications have been met by a modification of a 5-ton U. S. Air Conditioning Corp. RK self-contained unit. In the experimental rat room of the Bellevue Medical Center more than 100 rats are being used in experiments requiring accurate maintenance of constant temperature and humidity. A U. S. air conditioning ½-ton window type room air conditioner was installed in the room's only window.

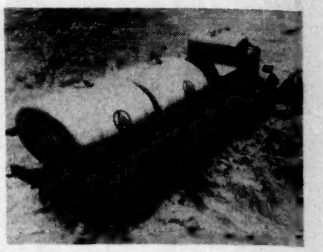
In the Grayson Foundation Laboratory, U. S. Air Conditioning Moduaire room air conditioners are used to supply filtered air to two experimental inoculating rooms.

**RESULTS:** In many research establishments, the maintenance of experimental animals in controlled atmospheres eliminates the variable effects of changes in temperatures and humidity. Results of experimentation are more clearly defined.

## Glass Fiber-Plastic Tanks Outwit Desert

**PROBLEM:** Replacement costs of steel tanks have always been a major problem of the Arabian American Oil Company in transporting fuel and water by truck across the Saudi Arabian deserts. A sandstorm rips off the paint, night dampness starts corrosion, the next sandstorm takes off the rust and the process starts all over again.

**SOLUTION:** Aramco is using a newly developed tank made of American Cyanamid's Laminac polyester resin reinforced with Owens-Corning's Fiberglas mat. As the tanks are stronger than steel, and lighter in weight, the plastic tanks can be made larger than steel ones, adding substantially to the payload. Both the water and fuel carrying tanks have smooth inside surfaces that can be steamed clean. Repair kits are available for quick repair of any ruptures caused by extreme driving hazards of desert sands. Repair requires only a simple cleaning of the ruptured area, and reinforcing the rupture with the plastic-impregnated fiberglas mat included in the kit. The tanks are molded by a special process by Carl N. Beetle Plastics Corporation of Fall River, Mass.



**RESULTS:** New tanks weigh 1000 lb mounted, have over ⅓ more capacity than steel tanks of the same weight. By overcoming the problem of corrosion, plastic tanks are expected to last from 10 to 50 times as long as steel ones, and ability to repair tanks without welding eliminates costly steam cleaning prior to repair.

## Partial Conditioning Cuts Home Cooling Cost

**PROBLEM:** Under construction in West Orange, New Jersey is a development of 89 low cost six-room houses which will feature summer air conditioning. It was necessary to devise a means of keeping air conditioning costs at a minimum in order to allow houses to be sold at competitive prices.

**RESULTS:** Builder Edward Schwartz, president of the Barclay Construction Co., Inc., of Newark, decided to zone the system in such a manner as to cool living portions during the day and sleeping quarters at night with a single 1-hp York Corporation unit located centrally. The unit makes use of ducts and outlet grilles of the gas fired forced warm air winter heating system. There are dampers in the ducts which allow the total cooling capacity to be directed to the chosen part of the house.

**RESULTS:** The zone system is an effective, inexpensive way to air condition the lived-in portion of a 6-room house. The addition of a second 1-hp unit which operates as an integral part of the original air conditioner is said to be simple.

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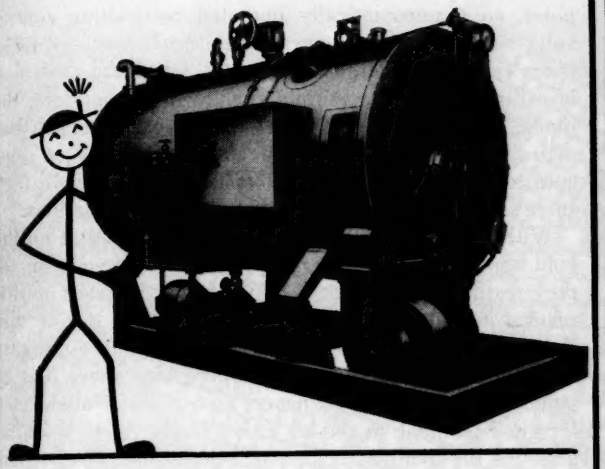

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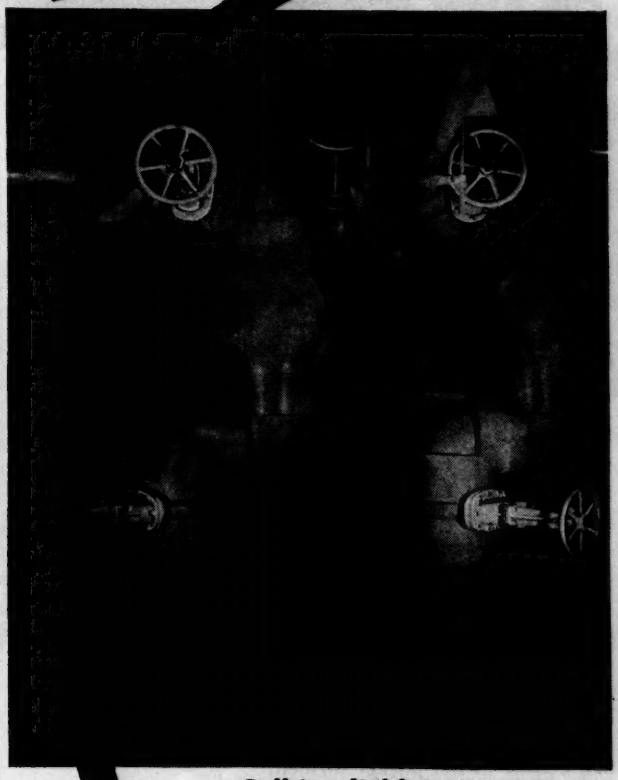

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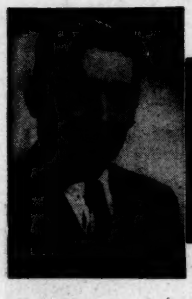

# Experience is my Classroom

By T. W. REYNOLDS

**• MODULATING CONTROL**

Laboratories, which have greatly increased in number since World War II, require close or accurate controls, usually of the modulating type. However, conditions affecting such controls must be right or there will be no control of any kind. So it was with interest I noted in my mail, Fig. 1, which depicts a combination of five things at a laboratory heating coil. Any one of these items alone can give trouble. Two of the major difficulties have been remedied, so the correspondent writes, and only time will tell how the others affect operation.

Modulating control, even where close control is required, is obtained through care when other conditions are normal. However, such control is apt to be difficult where steam pressures used are above 5 lb, although this pressure is sometimes stretched a bit to 10 lb. To add to the difficulties, the trap has a lift of 12 ft (due to a misunderstanding of the plans), the return is not under vacuum, and the trap is of the wrong type for the back pressure of well over 5 lb as imposed by the discharge pipe, lift, check, and flash steam. Finally, the piping is so arranged just before the modulating valve that condensate can collect in the pocket formed.

The major difficulty of the lift has been removed by connecting the return branch to a main at the floor below. Other plants may not have such a fortunate location of lower return. The second difficulty, and in importance, has been removed by substituting a float thermostatic continuous flow type of trap for the former inverted bucket type of trap with its intermittent action. The controls and specialties that were and are now being used are all of a good make and type, when used, where and as they are supposed to be used.

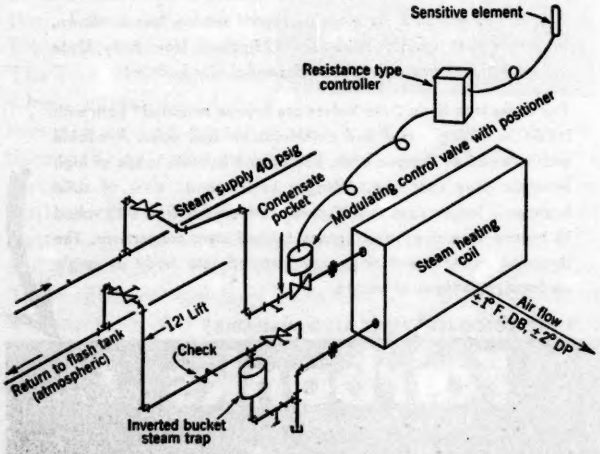


Fig. 1. A combination of conditions at a laboratory heating coil. Any one may give trouble.

Accuracy in the laboratory in question must be in the order of a half degree dry bulb and one degree of dew point, so a pneumatically operated modulating control valve was installed, together with a positioner and resistance type controller. Consequently, when the controller is calling for only a minute change in temperature, the modulating control valve opens a very small distance, thus acting as a reducing valve to reduce the 40 lb psi pressure to 5 lb, or even sub-atmospheric pressures. In fact, such valves have been used for reducing applications.

With the valve wide open, depending of course on the load imposed—the number of pounds of steam condensed, the pressure drop through the valve will increase until it reaches a point of maximum where the valve is in a fully closed position with 40 lb on one side and zero pressure or less on the other side. Steam pressures above 5 lb to modulating valves have never been found satisfactory for good modulation service at low loads. At 40 lb initial pressure, the sizing and characteristics of the valve become extremely critical.

The trap first used was of the bucket or dump type which loads up with quite a bit of condensate and then suddenly clears it. The second trap wisely used, practically allows a continuous flow of condensate from the coil whether the flow be large or small. Bucket type traps work best at steady load and may be wasteful on light load. Such a trap should have an internal thermostat to vent air quickly, so as to prevent waterlogging of the coil.

With a back pressure of 5 or 6 lb on this trap, any position of the modulating valve causing a pressure drop greater than 35 lb with an initial pressure of 40 lb would result in no steam flow through the coil, hence, there would be no control. If the load became heavy enough for the valve position to give a pressure drop of less than 35 lb, then there would be some flow regardless of whether or not there was a water leg after the trap.

If the initial steam pressure can be reasonably lowered, it would be best to use a vacuum return to induce a positive pressure differential between the coil and the return regardless of the lift. The differential should be great enough for the lowest surface temperature of the coil likely to be encountered. This would allow the temperature controllers to modulate between the highest steam pressure or temperature and the lowest sub-atmospheric pressure required in the coil. The conditions described are not as a rule present in most space heating control systems because of their time lag.

With a vacuum return it would be possible to use lift fittings at the lift to give better air and condensate removal. They also give quicker starting of the lift as the pocket or well is down below the horizontal pipe with a

(*Continued on page* 142)

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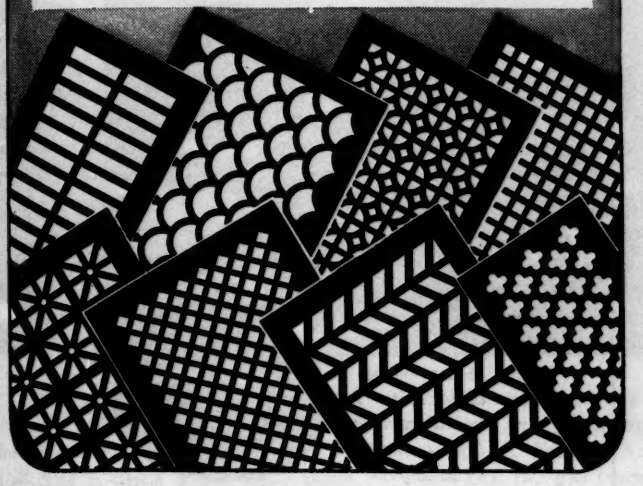

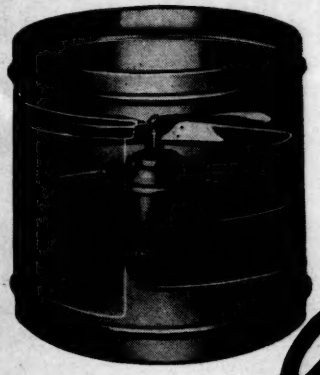

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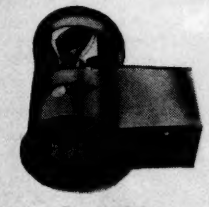
# Allen
## EXHAUST FANS



**Remote Drive Allen Staxauster** Specially designed for applications handling corrosives and/or high-temperature air.

Allen-engineered Exhaust Fans are efficient, easy to install, and economical to operate. The Fan Section shown above and the Remote Drive Staxauster present a range and diversity that enable you to solve almost any ventilating problem. For your wall installation needs, Allen Exhaust Fans and Lo-Noiz-Level Multiblade Fans are recommended. Advanced engineering design, skilled workmanship, and quality materials make Allen Exhaust Fans outstanding in the ventilating field. Our representatives are in most principal cities; names listed in our catalog in Sweet's Architectural File, Section 20b.

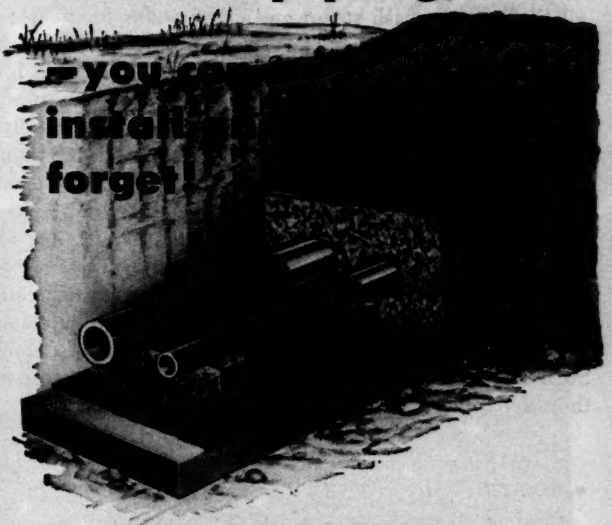
**Write for catalog on complete line of roof ventilators.**

ALLEN ENGINEERED VENTILATION

**PRODUCTION PLANNING CO.**
ROCHESTER, MICHIGAN

*Roof Ventilators for Every Commercial and Industrial Need*

# The PERMANENT Insulation for underground heated piping




# "Z-crete*

## CAST-IN-PLACE CONDUIT CONSTRUCTION

Z-CRETE is a lightweight insulating concrete which is poured monolithically around heated underground piping—insulates any size, number or arrangement of pipes. Contains no joints, no voids. Z-CRETE is as permanent as the earth itself!

## NO OTHER INSULATION FOR UNDERGROUND PIPING OFFERS ALL THESE ADVANTAGES!

- **More Adaptable**—Any number, size, or arrangement of pipes can be designed into one conduit.
- **More Economical**—Particularly in large pipe or multiple pipe conduits.
- **Permanent**—Will not rot or deteriorate, water-resistant. It is resilient, completely fireproof.
- **Efficient**—Solid monolithic insulation directly around pipes eliminates heat loss due to air movements. Six inches of insulation between pipes and outside of conduit.
- **Readily Available**—No critical materials. Experienced, licensed applicators, located in all parts of the country, are ready to serve you.

***WRITE FOR DETAILS TODAY!***

"Z-crete DIVISION

ZONOLITE COMPANY
135 S. LaSalle St.
Chicago 3, Illinois

Z-CRETE DIVISION, ZONOLITE COMPANY,
Dept. HV-92
135 S. LaSalle St., Chicago 3, Illinois

Please send FREE Z-CRETE Booklet for full details and specifications about this easier, better insulation of underground heated piping.

Name.....

Address.....

City.....Zone....State....

(*Continued from page* 140)

bore which would otherwise have to fill before the lift would start, resulting in the further handicap of a heavier load and higher water column.

The rising pipe should be of small diameter or area for easy filling from the pocket, and this small area, together with an inverted lift fitting at the top of the lift, would keep slugs of condensate from falling back. Of course, all lifts tend to flash steam and cause water hammer (a reason for a small diameter rising pipe), but they do eliminate the resistance and chatter of a check valve for no check is then needed. When check valves are used, they should be of the low resistance type. Incidentally, in England they sometimes use fins on the rising pipe, presumably to dissipate flash, although the time element seems to make such use questionable.

As will be noted in the sketch, there is a water leg or pocket at the entering side of the modulating valve. During such time as this valve is fully closed, steam will condense ahead of the valve. When the valve opens a small amount, condensate then flows through it instead of steam. Such a condition when under close control, is apt to cause the valve to go into a hunt while condensate is clearing.

### • TOO BIG

Lack of confidence that develops in early life, and over caution that results from sad experiences in later life may make an engineer tend to get things too big. He may design a residential heating system with a boiler, oil burner, radiators, pipes and air vents—all so large that there is too much condensate in such a fast working system at a given time. This would pertain particularly to a one-pipe steam system, but in a vacuum system there will be too much air for the pump to handle upon starting up cold. If only the radiators and pipes are oversized, there will be too much of a pick-up load.

When a boiler is oversized, there will be more water to heat up and a tendency to greater air leakage in the setting. Draft will be reduced by greater resistance and over-cooling, circulation will be more obstructed, flues will be so big that much of the gas does not wipe heating surface, and the grate will probably be too large; larger flues and less draft may allow dust to collect on heating surfaces.

A larger boiler usually has a larger chimney with more air and greater friction, cooling, downdrafts and eddies, one that is too full of cold air upon starting up. In addition, breechings and ducts also collect dust when sized too large, and over-size fans and air diffusers deliver too much air.

### • HIGHER TEMPERATURE vs. ADDED HEATING SURFACE

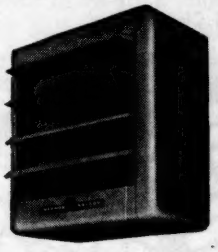
Increasing the amount of heating surface may sometimes be the means to obtain more output from a process; more often it is not. For example, adding a substantial length to a process heating coil in a liquid would lower the average temperature of the medium within the coil, but most of all the circulation of the medium would be reduced because of the added resistance, hence, the heat transfer could even be lessened.

(*Continued on page* 144)

*A unit heater for every need*

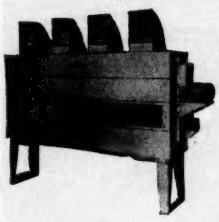
from

HERMAN NELSON

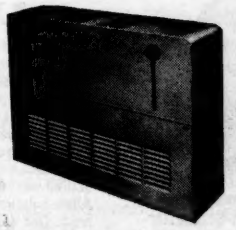


Horizontal Shaft Propeller-Fan Type Unit Heater—*the most generally useful of all space heaters.*

Vertical Shaft Propeller-Fan Type Unit Heater—*especially suited to buildings with high ceilings—up to 50 feet.*



Centrifugal-Fan Type Unit Heater—*for efficient heating and ventilating of large industrial spaces.*



De Luxe Unit Heater—*an attractive, quiet operating unit designed for stores, offices, churches, etc.*

AAF

Write for detailed information about any type Herman Nelson Unit Heater to Dept. HV-9.

herman nelson

HERMAN NELSON

...FROM

# HERMAN NELSON

Zero outside and the attendants in this pipe line pumping station work in comfort. For this and every other station of the gas transmission company are heated by Herman Nelson Vertical Shaft Unit Heaters.

Designed especially for high-ceiling buildings, this particular unit heater is widely used throughout industry. It operates on either steam or hot water. Its functional design and construction insure easy installation and minimum maintenance. It is modernly styled and attractively finished.

Far-sighted research, sound engineering, rugged, long lasting materials and superior craftsmanship make Herman Nelson tops in unit heaters —insure that they will give a lifetime of efficient, economical, trouble-free service.

SUPERIOR IN *BOTH* HEATING ELEMENT AND FAN DESIGN

**Herman Nelson Unit Heaters are suitable for the smallest service station or the largest factory. Each size unit does an extremely efficient job of heat transfer and distribution. This is because *both* heating element and fan are unique in design. Study the 7 points listed on the left and you'll see that every part has been carefully engineered to do its particular job.**

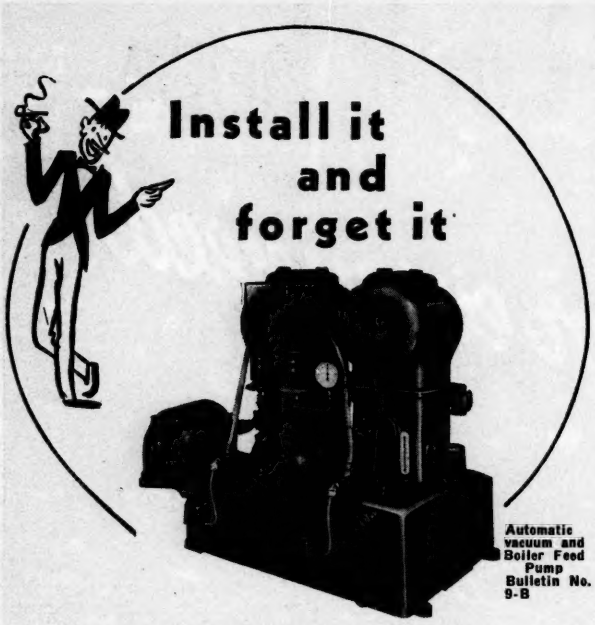
Write for your free Copy of New Unit Heater Catalog

AAF herman nelson

## HERMAN NELSON

*Division of* **AMERICAN AIR FILTER COMPANY, INC.**

**MOLINE, ILLINOIS**

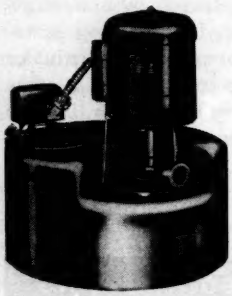



Automatic vacuum and Boiler Feed Pump Bulletin No. 9-B

. . . you can if it's a

*Skidmore Pump*

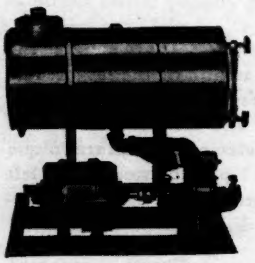
Consider the Skidmore Automatic Vacuum and Boiler Feed Pump — it adjusts itself automatically to varying conditions of the systems — capacity remains constant year after year, without adjustments or expensive repairs — operates quietly, economically and dependably under all normal conditions.



Type CV—Bulletin No. 21

**MINIMUM OPERATING PARTS**

The Skidmore Pump is designed with minimum operating parts —easily accessible without disturbing piping connections. Constructed with bronze impeler. Switches and motors are of proper capacity. Yes, once you install a Skidmore Pump you can forget it! for your maintenance worries are over.



Type TM—Bulletin No. 17

**SKIDMORE CORPORATION**
**ST. JOSEPH, MICHIGAN**

*There's a wide range of sizes and capacities for every heating pump need. Sales representatives in principal cities.*

**SKIDMORE PUMPS**


(*Continued from page* 142)

Increasing the temperature of the medium may be a better method because this increases not only the total heat transfer, but the rate of heat transfer. Such improvement in heat transfer is due not only to the greater temperature differential, but also to the increase in circulation caused by less viscosity of liquid, thinner films of liquid, and the elimination or reduction of films that are stagnant and obstructive to heat transfer, due to scale, air and condensate.

There may be other considerations to examine before deciding to use a higher temperature. Thus, the temperature must not be high enough to injure the product; flash steam, if any, at the higher pressure must be fully utilized or else there may be no economy produced by the change. Any proposed use of a higher temperature should also be checked against no material increase in radiation loss. High pressure pipes have higher temperatures, but do have smaller sizes and better covering, so that as a rule heat losses remain about the same.

In this connection, it should be remembered that in most practice the heat loss of piping continues during standby as well as during processing. Therefore, with increased output the standby period is reduced. However, even without this factor, the heat loss per pound of product output becomes ever less as output is increased. This reduces overhead to an extent that is often substantial in a large industrial plant and thereby renders relative heat losses of no moment.

### • NOISY WATER HEATERS

McRay Products Co. of California writes: "The article Cathodic Protection Against Corrosion of Heating and Plumbing Equipment" in the March, 1952, issue of HEATING AND VENTILATING was certainly an excellent example of a difficult subject well handled for easy understanding by the uninformed reader. Our only objection is that while every perimeter of the subject was explored, our Protecto rods, one of the most efficient controls of scale, electrolysis and corrosion, had to be interpreted from the sound conclusions you drew with reference to source of current and types of bi-metal construction for devices of this sort.

"It will be interesting for you to know that replacement of magnesium anodes with our Protecto rods has been the answer to the following problems in hot water heaters:

"(1) Elimination of foul odors where sulfur-content waters combined with magnesium to form magnesium sulfide.

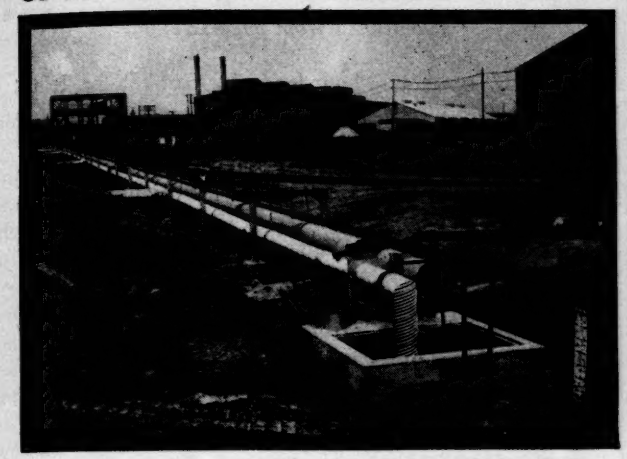
"(2) Elimination of frightening pounding noises due to heavily encrusted scale on thermostats and heating pan.

"(3) Elimination of electrolysis in bi-metal plumbing conditions where copper water pipes come in contact with ferrous heater in spite of plastic gasket bushing between metals.

"Each of these conditions, with the exception of the ease with which magnesium combines with elements, had clear effective coverage in your article."

For the benefit of the reader, rod consists of alternate zinc and copper plates assembled as a battery. The rod is used in water heaters, in the radiators of automobiles and trucks to prevent scale and corrosion and to loosen existing scale; also in boilers, tanks and oil wells.

# RIC-WIL RECORD... 10,000,000 FEET OF TOP-EFFICIENCY INSULATED PIPING!



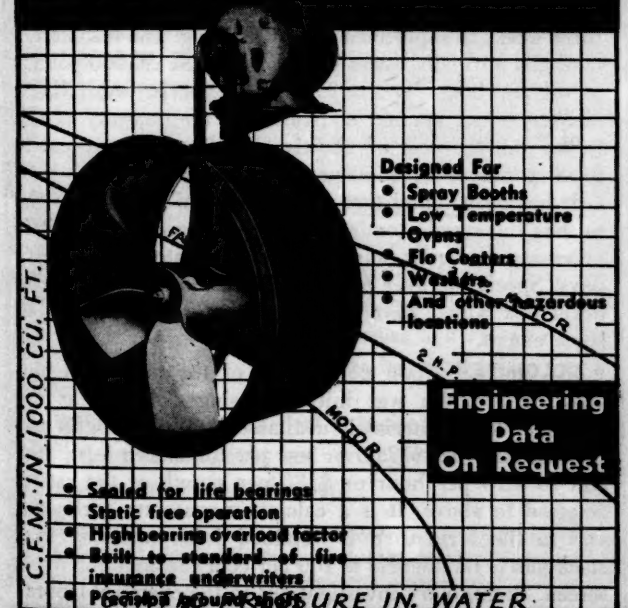
During the past forty years, Ric-wiL has designed and manufactured over 10,000,000 feet of high-efficiency conduit systems and Prefabricated Insulated Piping. In thousands of industrial, commercial and residential installations, Ric-wiL operating performance has proved to engineers, architects and contractors that Ric-wiL is "the Greatest Name in Insulated Piping Systems".

Ric-wiL PREFABRICATED INSULATED PIPING

UNDERGROUND OR OVERHEAD

THE RIC-WIL COMPANY · CLEVELAND, O.

# M&E HEAVY DUTY EXHAUST UNIT for Hazardous Locations




Engineering Data On Request

M & E Manufacturing Company

2575 Winthrop Ave Indianapolis Indiana

# Look here

for complete flow information!

ALL THREE DIALS IN SINGLE CASE — 7 digit totalizer, 10" long rate indicator, 12" uniformly graduated chart record.

HIGH ACCURACY and WIDE RANGE — within 1% over a range from 100% to 10% of rated capacity.

ENDURING ACCURACY — "power plant" consists of wells containing a generous amount of mercury and a broad, solid float with a long travel, to provide years of sensitive, accurate, trouble-free operation.

READILY ADAPTED FOR PROPORTIONAL CONTROL of chemical feeders and/or for operating remotely located instruments or equipment.

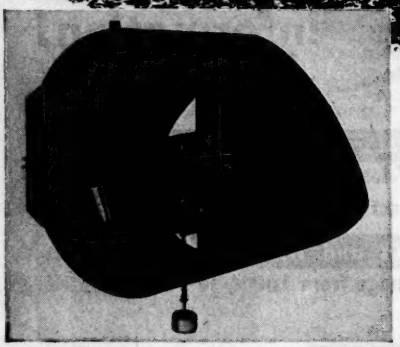
•

Send for Bulletin describing Builders Flo-Watch Totalizer-Indicator-Recorder. Builders-Providence, Inc. (Division of Builders Iron Foundry), 469 Harris Ave., Providence 1, R. I.

BIF INDUSTRIES — BUILDERS PROVIDENCE Instruments — BIF BUILDERS

it's another Field
First and Best!

"M-G" Double-Acting
Field Draft Control for
gas
Fired Heating Plants*



*Available at present in commercial sizes only.

Now there's a Field for gas, too! And the same accuracy and sensitivity that have made Field first for coal and oil-fired heating plants make the new Field "M-G" first for gas-fired heating plants. It's the first and only barometric draft control engineered exclusively for gas. Write today for complete details.

SAFETY SWITCH
Optional auxiliary switch will close main gas valve or sound alarm in case of blocked flue or prolonged down-draft, preventing escape of carbon monoxide into building.

The Draft Control ... that's advertised nationally in *BETTER HOMES & GARDENS*

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AFFILIATES:
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Cranes - Hoists



## BOILER SLAGGING

(*Continued from page* 134)

practically constant 24-hour load of 275,000 lb/hr. It has a tube-to-tube furnace, fired with six Y-jet burners. The oil burned is a No. 6 fuel oil. An analysis of a sample of this oil showed 3.0% sulfur and an average ash content of approximately .15%. Noticeable quantities of water in the oil were not uncommon. The oil is delivered to the station by barge and each shipment is sampled and checked for ash content.

This boiler has been in operation since 1947 and has been normally removed from service twice each year for cleaning. During operating periods, in addition to the use of sootblowers every eight hours, including three retractable units in the superheater cavity, it has been necessary to water-lance the superheater and air-lance and water-wash the airheater. To do this, a cleaning gang was employed three or four nights a week. During shut-down, the cleaning process involved soaking the cold boiler tubes with water for two or three days to loosen the deposits and considerable hand work was required to remove the hard clinging portions. The cleaning process required several days to complete.

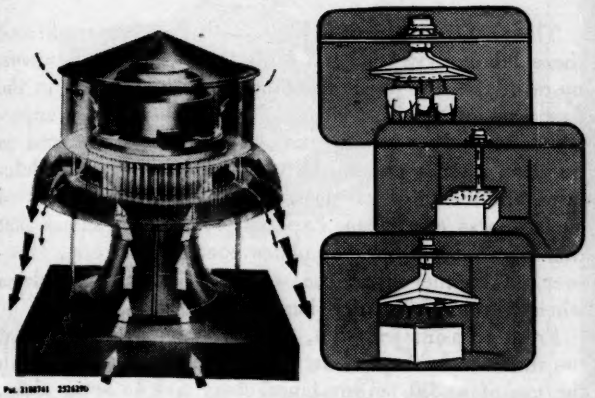
• **ALUMINA.**—The results of the alumina tests bore out the Research Center findings that the deposits in the superheater region were changed from a dense hard slag to a relatively soft ash and indicated that it should be possible to keep the unit on the line indefinitely if the furnace walls, screen tubes, and superheater tubes were lanced with air at 225 psi about once a week. It was found advisable to clean the airheater after this lancing to remove the material blown there from the boiler superheater and economizer tubes. The use of the sootblowers has not been necessary; however, boiler water has been usd on the retractable sootblowers approximately once every three weeks to supplement the air-lancing. The installation at Inglis normally burns slightly less than 20,000 pounds of oil per hour for the 275,000 lb per hr load. Using alumina in an amount equivalent to the quantity of ash in the oil, the cost of additive has been approximately $1.00 per hour or $750 per month.

It has been found that the addition of alumina to the oil has increased atomizer wear to the point where it is necessary to renew standard sprayer plates every thirty days. Special sprayer plates of hardened steel have been developed which have alleviated this wear problem to some extent.

• **DOLOMITE.**—Upon completion of the tests with alumina, a program was initiated using dolomite as the additive. This material is available locally at Inglis and is obtainable for $12.00 or less per ton which is equivalent to $.18 per hour or $130 per month at the rating referred to above. It is a calcium-magnesium carbonate and in the form used is obtained from calcining kiln stack gases. Its fineness is 100 per cent through 325 mesh screen. Preliminary investigations in the chemical laboratory at the B&W Research Center had indicated that results comparable to those obtained with alumina could be anticipated.

(*Continued on page* 148)

## IT PAYS to know these Facts about Exhausting Moisture and Fumes



**CERTIFIED RATINGS:** Gallaher Air Vans are tested by an independent laboratory — a test of the whole unit *not* just the fan wheel. You can be sure of Gallaher performance data — it's tested *not* interpolated.

**EFFICIENT:** SCROLL EFFECT designed into the unit and exclusive with Gallaher. Research tests show that efficiency against *even normal* static pressures is not possible without it.

**SAFE MOISTURE AND FUME REMOVAL**—Motor out of the air steam with the exclusive patented air seal off to make it certain. How safe? Gallaher units are safely used for ether and air concentrations *without* explosion proof motors.

**STRONG:** We invite comparison with any comparable unit. Our specifications are *published* and available by asking your local Gallaher representative or writing Dept. A, 4108 Dodge Street, Omaha, Nebr.

**Capacities 150-11,000 CFM; Static Pressures to 1¾"**

**The GALLAHER Company**
Omaha, Nebr. Owatonna, Minn.



## ONLY CYCLONIC COMBUSTION GIVES . . .

## 66% MORE POWER per sq. ft. of heating surface

By reducing heating surface requirements from 5 to just 3 sq. ft. per B.H.P., Cyclonic Combustion produces 66% more power per sq. ft.—saves up to ⅓ the space of conventional package steam generators. Cyclonic Combustion is the revolutionary new flame control used exclusively in Cyclotherm steam generators. Flame characteristics are controlled in a revolving spiral vortex traveling the full length of the furnace to insure maximum heat transfer without direct flame impingements or hot spots. The cyclonic action of the flame accounts for a 65 to 75% heat transfer within the main fire-tube. This high rate of heat transfer enables Cyclotherm 2 pass generators to maintain a guaranteed minimum efficiency of 80% for any steam requirement.

Cyclotherm steam generators with patented Cyclonic Combustion offer these additional features: Full power operation from a cold start in 15 to 20 minutes; Savings up to 50% on maintenance; Greater fuel savings; Boilers designed for oil or gas operation from 18 to 500 h.p., 15 to 200 psi operation pressure.

Proved superior in thousands of installations, Cyclotherm steam generators with new Cyclonic Combustion offer the most efficient and compact package steam generator on the market today. Find out more about Cyclotherm and Cyclonic Combustion—write today for a free illustrated folder.

The Cyclotherm meets all state requirements and is built in accordance with A.S.M.E. and National Board Standards and bears the label of Underwriters Laboratories, Inc.

**CYCLOTHERM STEAM GENERATORS**

Cyclotherm Division U. S. Radiator Corp.
Dept. 27
Oswego, New York

Please send without obligation my copy of "All Your Questions Are Answered by Cyclotherm."

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FIRM _____
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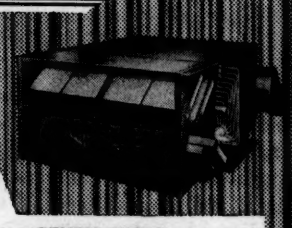
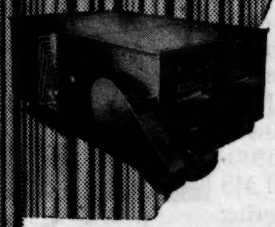
## MASSACHUSETTS PRESENTS

**THE NEW MASSACHUSETTS AIR CONDITIONING UNITS**





**SEVEN SIZES . . . . .** available, ranging from 1,000 to 14,000 C.F.M. Designed to combine cooling in summer, heating in winter.

**Built in sections - Vertical or horizontal mounting. Various combinations and arrangements of discharge and by-pass damper.**

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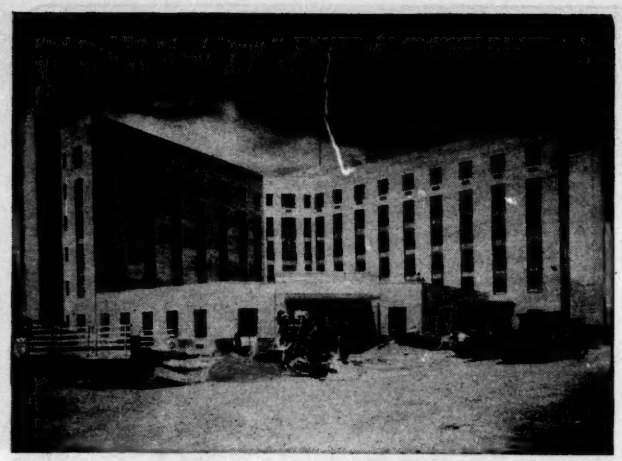
**The BISHOP & BABCOCK Mfg. Co.**
4901 HAMILTON AVENUE CLEVELAND 14 OHIO



*Here's where a piping contractor has to mind* his P's and Q's

Probably we should say L's and T's!

Anyway, the labor cost on a big job like this could exceed the estimate if the men lost time with badly threaded fittings . . . couldn't run 'em up to make tight joints . . . broke 'em when applying the heave-ho.

And then, if the joints seeped or the fittings themselves leaked under pressure, the contractor would lose money on call-backs and make-goods.

Not so on this job! The contractor selected "K" Fittings. He knows by experience that the threads are tapped full and clean . . . that the walls are uniformly thick . . . that the bodies are sound, close-grained, and with much higher than standard tensile strength.

It's smart to get fittings from a distributor who handles the Kuhns line—the precision-made fittings identified by the "K" trade-mark.

K CAST-IRON FITTINGS
3000 SHAPES AND SIZES

THE KUHNS BROTHERS COMPANY

## BOILER SLAGGING

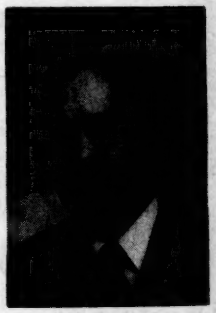
(*Continued from page* 146)

The results obtained at Inglis with dolomite confirmed these laboratory findings. With the dolomite, however, more of the fine powdery material was deposited in the first pass of the superheater. That section of the superheater extending into the second gas pass was found to be clean after a two-month operating period with dolomite, and the third gas pass, consisting only of saturated surface, was also clean. Experience at Inglis shows that the wear rate of sprayer plates continued strong. However, at another plant the wear rate of sprayer plates when dolomite was used has been slight.

From an ash standpoint, there is every indication that the unit can be kept clean for an indefinite period with the use of a 200 psi air lance every five to seven days. However, it is necessary that lance doors be provided so that all the rows of tubes are accessible. It is necessary to have the air jet discharge close to the ash that is being removed.

• **LOWER DEW POINT.**— In addition to raising the fusing temperatures of ash there are indications that the additives contribute another significant advantage in lowering the dew point of flue gases. The effect of dolomite on airheater corrosion is not yet fully known; however, the major constituent in the dolomite additive ash is $CaSO_4$, so that probably a much smaller amount of free $SO_3$ is present in the gases passing through the airheater. A suitable apparatus for checking dew points of gases has indicated that there may be a difference between dew point temperatures when firing the same oil with and without additives.

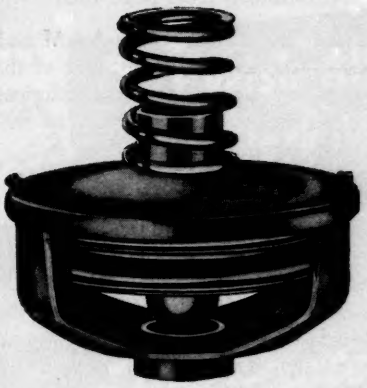
## GETTING PERSONAL



W. E. Long

**Wayne E. Long** (*Thermal Characteristics of Ceramic Houses*, page 77) is professor of mechanical engineering at the University of Texas and has had a broad experience in teaching air conditioning, refrigeration and related heat power subjects at Texas Technological College (1928-30), Texas A&M College (1930-48) and the University of Texas (1948-52). He received both BS and MS degrees in Mechanical Engineering from Texas A & M and has done summer study in air conditioning at Purdue. At the present time he is studying part time on his PhD degree in engineering at the University of Texas. During World War II Professor Long spent four years in the armed forces in the Signal Corps and the Corps of Engineers in which he now holds the reserve rank of Major. He spent two years in engineering construction in the Southwest Pacific Theater during the war. Professor Long has been active in research, especially in the field of air condition-

(*Continued on page* 150)



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(*Continued from page* 148)

ing and heat transfer, at both Texas A & M and the University of Texas. He has been a member of the ASHVE since 1935 and is now a member of the technical advisory sub-committee on radiant heating and of the ASHVE Guide publication committee.

R. W. Olsen

**Ronald Walter Olsen** (co-author, *Factors Affecting the Efficient Burning of Oil, page* 87) was born in Grand Forks, N. D. In 1930 he received his B. S. in E. E. from the University of North Dakota and then joined the General Electric Co. as test engineer.

The following year he was placed in charge of testing in the G. E. oil burner development laboratory. From 1937 to 1939 he worked as design engineer on heating equipment. He acquired six patents on controls. In 1939 he transferred to field engineering and spent several years in the east and midwest areas. In 1942 Mr. Olsen became supervisor of the Headquarters Field Engineering Division. He spent a year in rewriting and expanding service instructions on all G. E. oil-fired equipment.

In addition to heating equipment, he now has the responsibility for service and installation methods and instructions for heat pumps and home air conditioners.

**C. M. toeLaer** (co-author, *Factors Affecting the Efficient Burning of Oil, page* 87), who has had several articles published in HEATING AND VENTILATING, received his B.S. in E. E. from Armour Institute of Technology in 1940. Since the publication of his biography in the June, 1950 issue, he has been made application engineer in the Home Heating and Cooling Department of G. E.

He is very active in the National Warm Air Heating and Air Conditioning Association, participating in several of the associations technical committees. He is also a member of ASHVE.

W. K. Eister

**Warren K. Eister** (*Treatment of Radioactive Wastes*, page 81) has been in the processing phase of the atomic energy business since 1943. He received his BSChE degree from Bucknell University in 1940 and was employed by du Pont in the smokeless powder industry prior to entering atomic energy. He is a member of the AEC Waste Processing Working Group which has as its objective the evaluation of processing techniques employed by the various AEC contractors to dispose of radioactive wastes. While in the atomic energy business he was first employed by du Pont, later the Monsanto Chemical Company and since 1948 has been with the Carbide and Carbon Chemicals Company which operates Oak Ridge National Laboratory for AEC. At the present time he is a staff member of the Chemical Technology Division at Oak Ridge National Laboratory.

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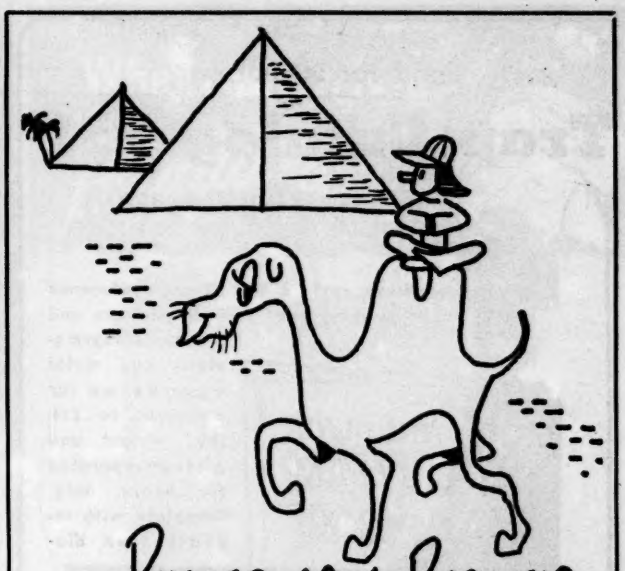

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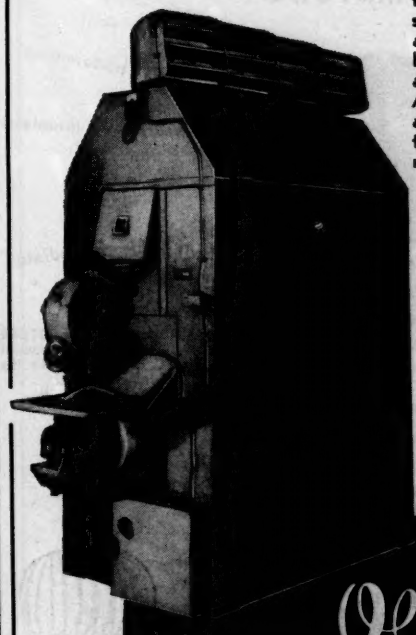

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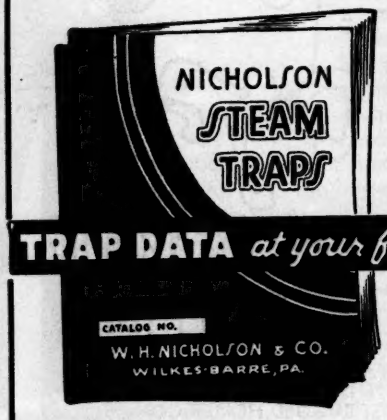


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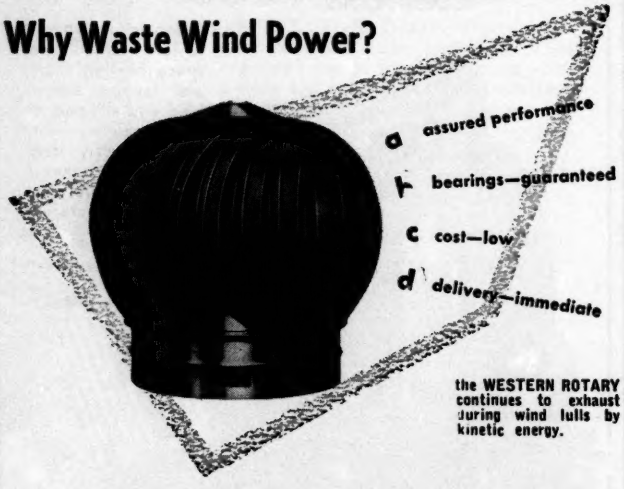


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# COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

**ASME MEETING**—Fall meeting of the American Society of Mechanical Engineers, at the Sheraton Hotel, Chicago, Ill. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. . . . . **SEPTEMBER 8-11, 1952.**

**INSTRUMENT CONFERENCE AND EXHIBIT**—Seventh National Instrument conference and exhibit, in Cleveland, Ohio. John McCaffery, assistant executive secretary of the Society, 1319 Allegheny Ave., Pittsburgh 33, Pa. . . . . **SEPTEMBER 8-12, 1952.**

**NACE MEETING** — South Central Region's meeting of the National Association of Corrosion Engineers, in New Orleans, La. Secretary of the Association, 1061 M & M Building, Houston 2, Texas . . . . . **OCTOBER 1-3, 1952.**

**WELDING MEETING**—Annual meeting of the American Welding Society at the Bellevue-Stratford Hotel, Philadelphia, Pa. I. G. McGrath, secretary of the Society, 33 W. 39th St., New York 18, N. Y. . . . . **OCTOBER 19-24, 1952**

**AGA CONVENTION**—Annual convention of the American Gas Association, in the Auditorium, Atlantic City, New Jersey. Secretary of the Association, 420 Lexington Avenue, New York, N. Y. . . . . **OCTOBER 27-30, 1952.**

**GAMA EXPOSITION**—Exposition of the Gas Appliance Manufacturers Association at Convention Hall, Atlantic City, N. J., held in conjunction with the AGA convention. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York, N. Y. . . . . **OCTOBER 27-31, 1952.**

**SANITARY ENGINEERING MEETING**—46th annual meeting of the American Society of Sanitary Engineering, at the McAllister Hotel, Miami, Fla. Herbert Schalber, annual meeting city chairman, 46 N. E. 6th St., Miami, Fla. . . . . **NOVEMBER 15-20, 1952.**

**ASA MEETING**—34th annual meeting of the American Standards Association, at the Waldorf Astoria Hotel, New York, N. Y. Secretary of the Association, 70 East 45th Street, New York. . . . . **NOVEMBER 19, 1952.**

**ASME MEETING**—Annual meeting of the American Society of Mechanical Engineers, at the Hotel Statler, New York, N. Y. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. . . . **NOVEMBER 30-DECEMBER 5, 1952.**

**NATIONAL POWER SHOW**—20th National Exposition of Power and Mechanical Engineering, under the auspices of the American Society of Mechanical Engineers, at Grand Central Palace, New York, N. Y. Charles F. Roth, manager of the Exposition, Grand Central Palace, New York 17, N. Y. . . . . **DECEMBER 1-6, 1952.**

**AUTOMOTIVE ENGINEERS MEETING**—Annual meeting and engineering display of the Society of Automotive Engineers, at at the Sheraton-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 West 39th St., New York, N. Y. . . . . **JANUARY 12-16 1953.**

**PLANT MAINTENANCE SHOW AND CONFERENCE**—Plant Maintenance show and conference at the Public Auditorium, Cleveland, Ohio. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. . . . . **JANUARY 19-22, 1953.**

**HEATING WHOLESALERS MEETING**—The annual meeting of the National Heating Wholesalers Association, Inc., at the Congress Hotel, Chicago, Ill. E. L. Wyman, executive secretary of the Association, 637 Union Commerce Building, Cleveland 14, Ohio. . . . . **JANUARY 26-28, 1953.**

**ASHVE EXPOSITION**—The Air Conditioning Exposition, under the auspices of The American Society of Heating and Ventilating Engineers, at the International Amphitheatre, Chicago, Ill. Write to exposition management, International Exposition Co., Inc., Grand Central Palace, New York 17, N. Y. . . . . **JANUARY 26-30, 1953.**

**ASHVE MEETING**—59th annual meeting of the American Society of Heating and Ventilating Engineers, at the Conrad Hilton Hotel, Chicago, Ill. A. V. Hutchinson, secretary of the Society, 62 Worth St., New York 13, N. Y. . . . . **JANUARY 26-30, 1953.**

**NDHA MEETING**—44th annual meeting of the National District Heating Association, at Lookout Mountain Hotel, Chattanooga, Tenn. John F. Collins, secretary of the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. . . . . **JUNE 9-12, 1953.**

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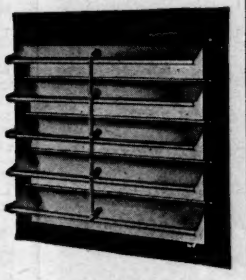

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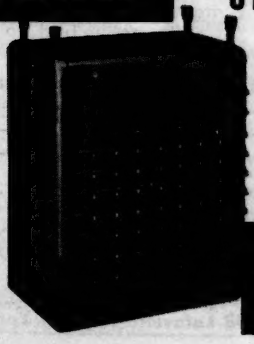

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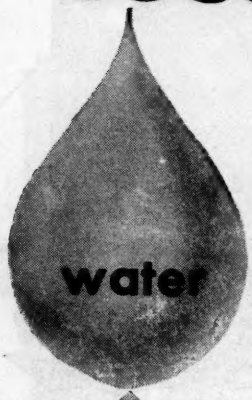


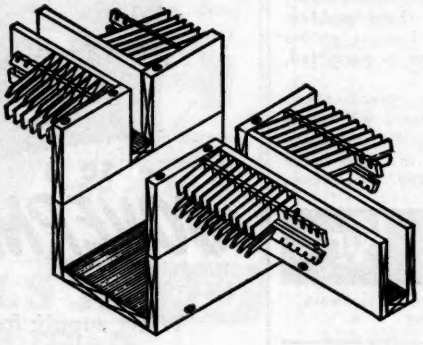

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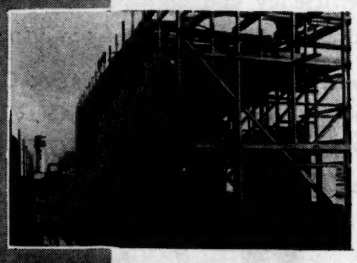

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## COMPANY NOTES

• J. Gordon King, vice president of Owens-Illinois Glass Co. and manager of glass container production, has been named general manager of the Kaylo Division. He succeeds Thomas A. Collins, who is resigning to accept a position with another company. Mr. King, a graduate of McGill University, joined the General Manufacturing Division of Owens-Illinois in 1932. Three years later he was made Chief Engineer of the Company's Pacific Coast Division in San Francisco. In 1940 he returned to the General Offices, Toledo, as manager of the Production Control Wepartment.

• Thomas A. Collins has been elected to the newly-created position of executive vice president of Glass Fibers Inc., Toledo, Ohio. Mr. Collins has spent his entire business career in the glass and glass fiber industry. He began with Owens-Illinois in 1926 as supervisor of mold manufacturing. He recently resigned as General Manager of the Kaylo Division.

• Milton R. Paulsen, formerly instructor of heating and air conditioning, Milwaukee School of Engineering, Milwaukee, has been named manager of the training department of The Trane Co., La Crosse, Wis. Mr. Paulsen will direct the intensive post graduate course in air conditioning and heating engineering founded in 1925 by Reuben N. Trane. As director of the Milwaukee school's refrigeration, heating and air conditioning division, and head of the air conditioning department, Mr. Paulsen developed new curricula at engineering, technician and service levels. During the past year he has been a development engineer with Cleaver Brooks Company, Milwaukee.

• Perfection Stove Co., Cleveland, Ohio, announces the appointment of Mr. H. C. Erhard as sales manager of its contract sales department. Assistant sales manager of the same department will be Mr. H. E. Thomas. Currently, Perfection engineers and technicians in a newly built Polar laboratory in Cleveland are working in temperatures ranging from —70F to —80F. The laboratory temperature, however, can be brought down to as low at 90 degrees below zero. Perfection built the cold laboratory, at a cost of $250,000.


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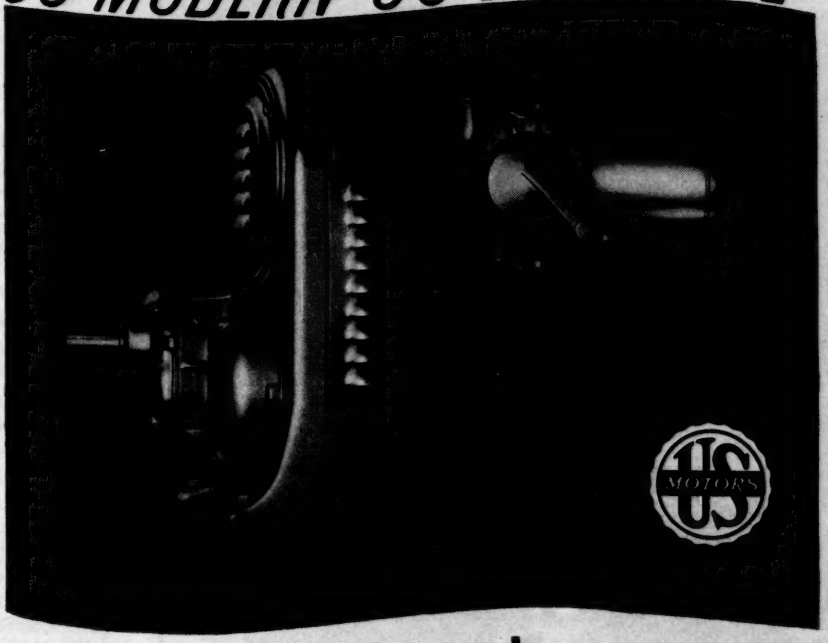


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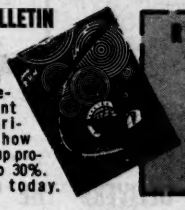

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• • •

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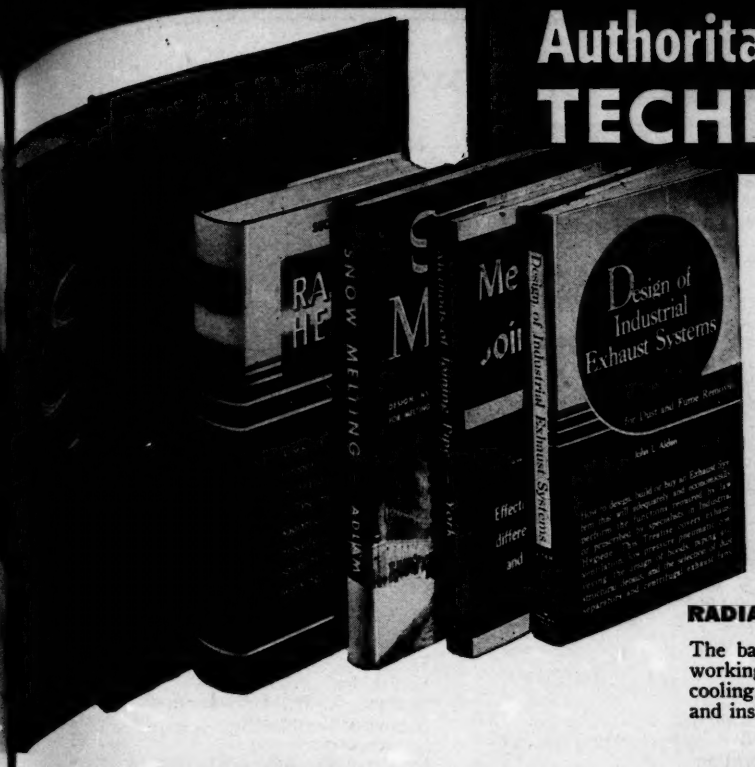


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# SOLAR RADIATION IN WARM AND HOT MONTHS

The accompanying charts, prepared by Sigmund Fritz and Torrence H. MacDonald of the U. S. Weather Bureau, show the *average daily* amounts of solar radiation received on a horizontal surface throughout the U. S. The average is of all days for each month. The quantities are expressed in langleys, a unit abbreviated to ly, one langley being one gram-calorie per square centimeter. If the lys are multiplied by 3.69, the result will be in Btu per square foot.

In other words, the figures from the maps multiplied by 3.69 will give the Btu falling on a horizontal square foot per average day in that month, and the average includes all days regardless of degree of cloudiness.

The solar radiation data were collected from stations at Blue Hill, Mass.; Newport, R. I.; Madison, Wis.; Twin Falls, Idaho; Washington, D. C.; Lincoln, Neb.; Fresno, Calif.; Riverside, Calif.; New Orleans, La.; La Jolla, Calif.; and Miami, Fla. Data for other locations were calculated as explained by Messrs Fritz and MacDonald in HEATING AND VENTILATING, July, 1949.

An example of the use of the charts is as follows:

*Example.* What would be the total heat received from the sun by a horizontal surface during June, July and August in Chicago, Ill.?

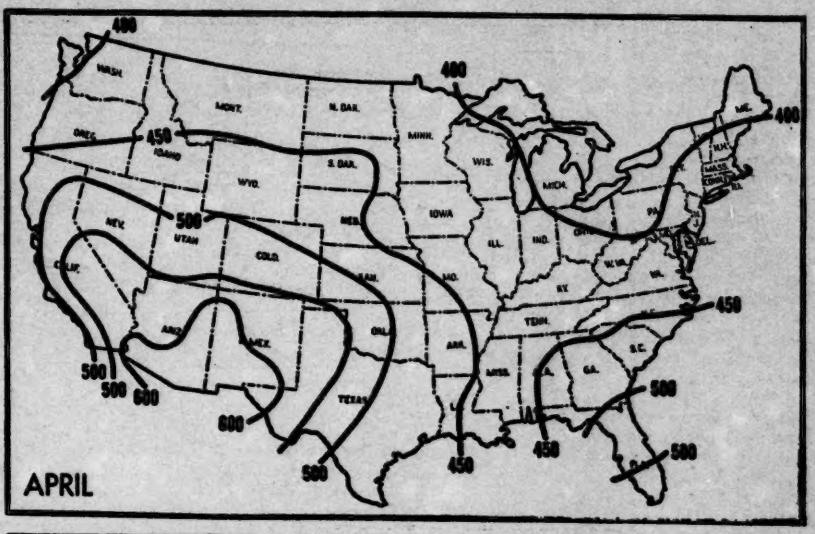
*Solution.* From the charts, by interpolation, the figures are 550, 550, and 460 ly per average day for June, July and August, respectively. Converting to Btu per month the figures would be

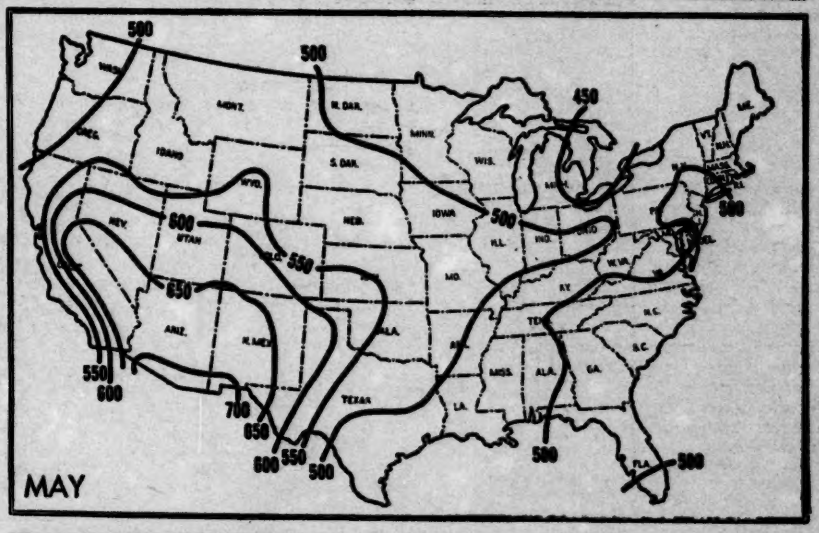
Jun. $550 \times 3.69 \times 30 = 60{,}885$

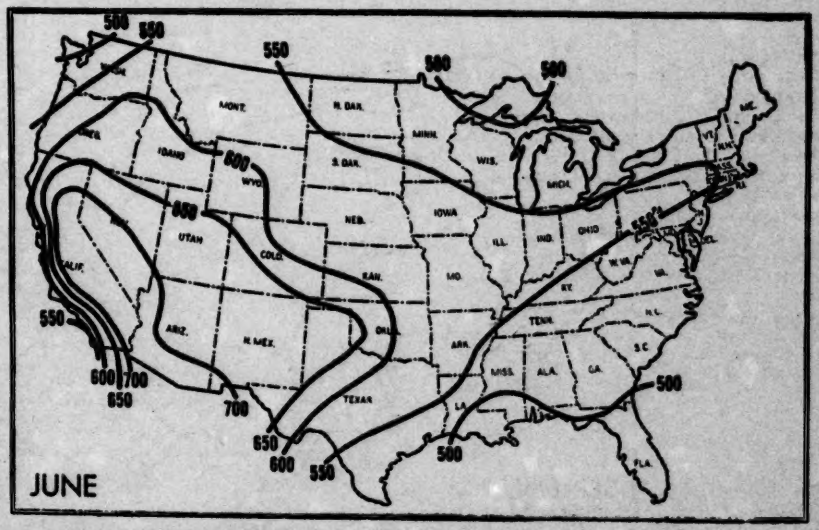
Jul. $550 \times 3.69 \times 31 = 62{,}915$

Aug. $460 \times 3.69 \times 31 = 52{,}619$

Total Btu per sq ft 176,419



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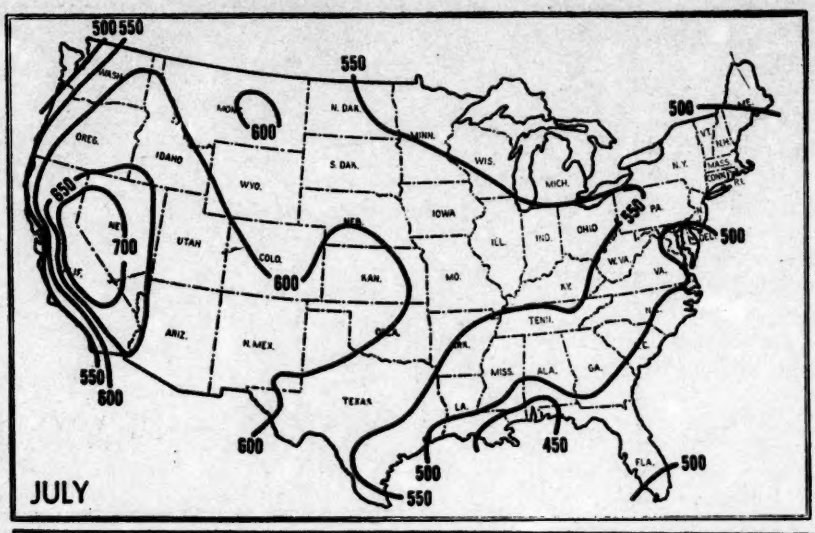


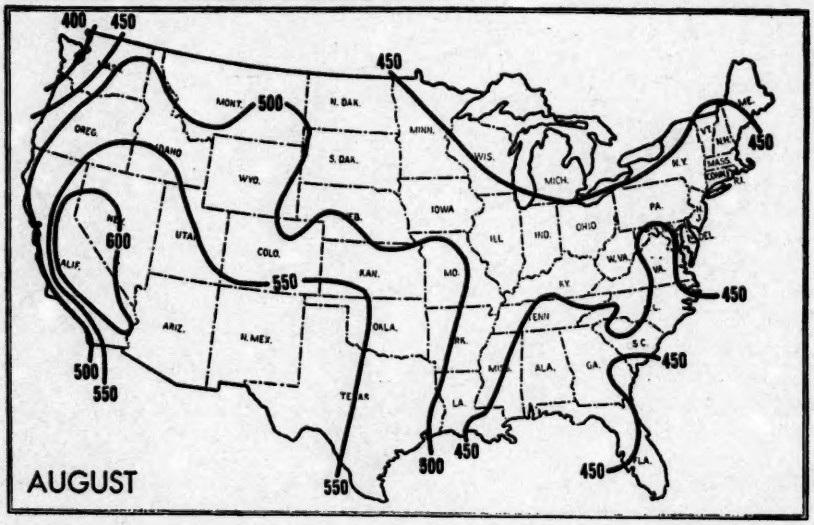


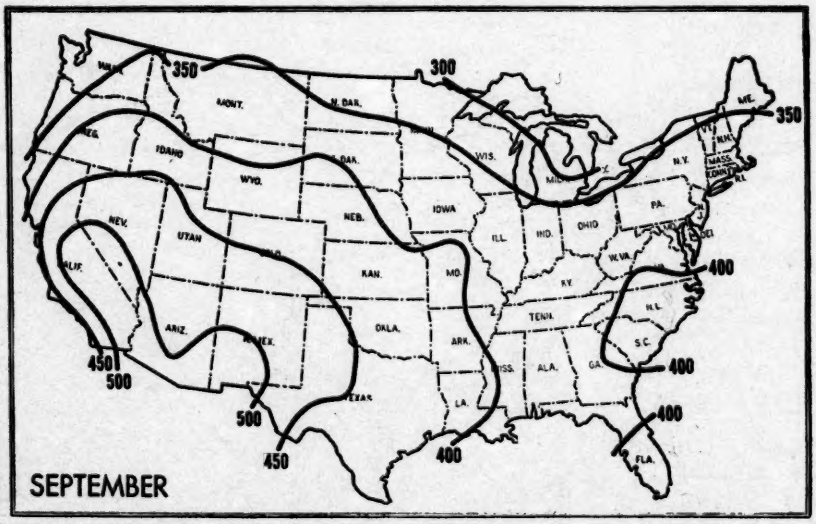


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September, 1952

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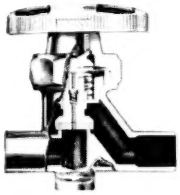
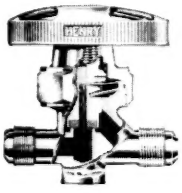


### STANDARD TYPE

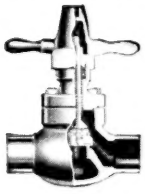
Ball check in balancing channel permits diaphragm inspection and replacement with valves under line pressure. Sizes, ¼" thru ⅝" flare; ¼" thru 1⅝" O.D. Solder, ¼" thru 1" F.P.T.



### BLUE BANTAM TYPE

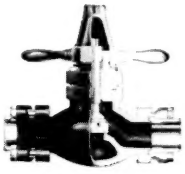
Same as standard Balanced-Action valve except that diaphragms cannot be inspected or replaced under line pressure. Size ¼" thru ⅝" flare and O.D. Solder.

## PACKED VALVES FOR FREON Bronze-Wing Cap Type



Globe and angle types with solder connections, bolted bonnets, sizes ⅞" thru 5⅛" O.D.

### SEMI-STEEL WING CAP TYPE



With bolted bonnets and square companion flanges. Furnished with brass tailpieces (O.D. Solder) 1⅜" thru 5⅛" or with steel tailpieces for welding to pipe, sizes 1¼" thru 5".

Also Globe and angle types with F.P.T. connections, sizes ½" thru 2".

## PACKED VALVES FOR AMMONIA Permanent-Mold Iron and Semi-Steel

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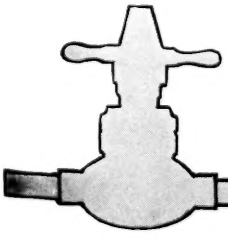

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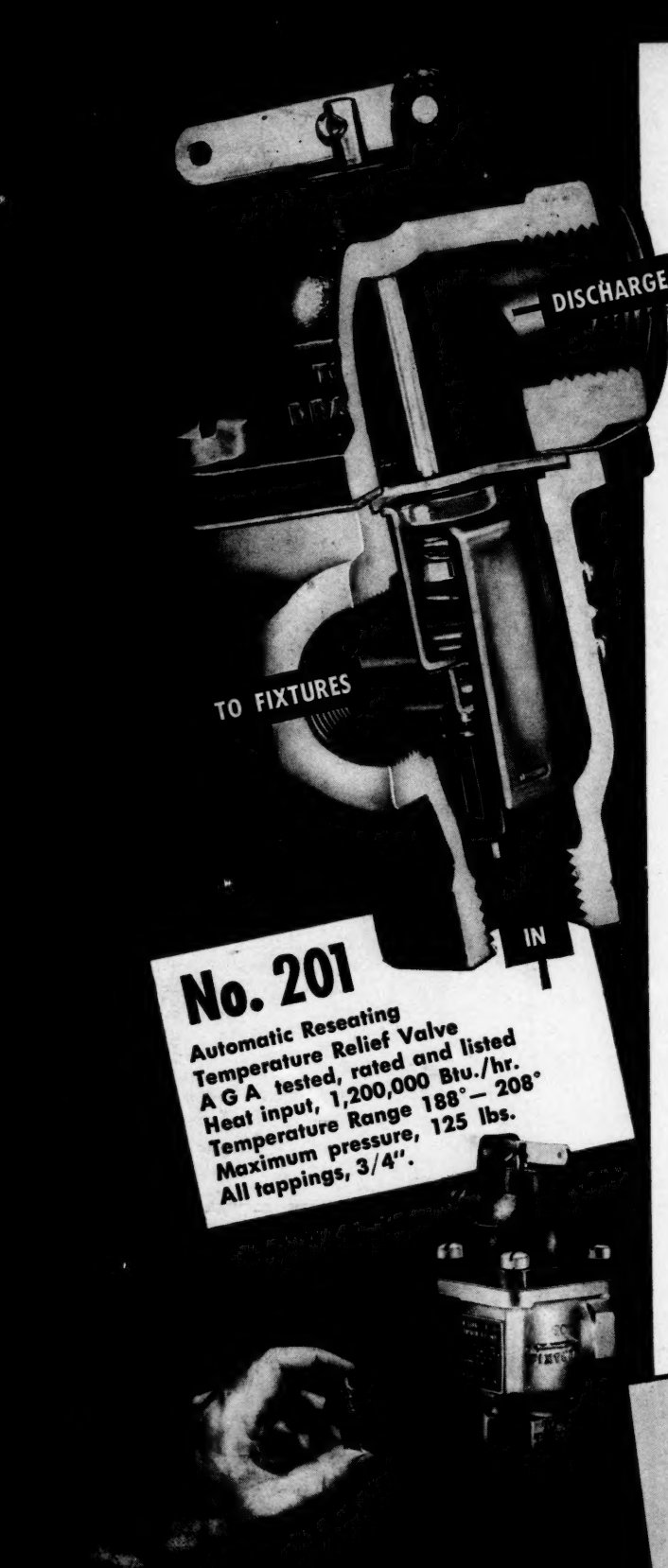


# "...the only sure-footed temperature relief valve I've ever seen!"

That's what a consulting engineer had to say about the McDonnell No. 201 Temperature Relief Valve. It's one of the many prized compliments that are coming in now that hundreds of these valves are in service telling their own convincing story on the job.

We particularly like the way contractors are describing the No. 201 with words like "sure-footed" and "positive." For that's exactly what former temperature valves were *not*, and exactly what this valve *is*.

Yes, positive and precise operation is what contractors have been seeking for a long time in a temperature relief valve — a valve that will open up at a predetermined temperature; do its job; then close drip-tight as soon as its job is done. No wonder so many of them have been startled to find that this has finally been accomplished in the No. 201.

The illustrations show how we did it. We designed a valve with big, free-flowing waterways (equal to ¾-inch pipe) and made an extra tapping so that the service-flow can pass right through the valve (see Installation drawing). As a result, the thermostatic element is always subjected to the actual temperature at which the water is used.

For the thermostatic element we developed an adaptation of the ingenious Vernatherm element. This little element can be held in the palm of your hand; yet it has the power to easily open the valve at 188°F. and lift it to full opening at 208°F. The Valve reseats drip-tight when temperature at element drops down only five degrees below opening temperature.

Other advanced features of the No. 201 are listed below. Note its big, A G A tested capacity,* pull-down test lever, better construction throughout. Ask for Bulletin L-107 giving complete details.

**No. 201**

**Automatic Reseating Temperature Relief Valve**
**A G A tested, rated and listed**
**Heat input, 1,200,000 Btu./hr.**
**Temperature Range 188°— 208°**
**Maximum pressure, 125 lbs.**
**All tappings, 3/4".**

**McDONNELL & MILLER, INC., 3500 N. Spaulding Ave., Chicago 18, Ill.**

*Doing One Thing Well*

# McDONNELL

## *Boiler Safety Devices*

### Never before a valve like this

**Positive operation:** Starts to open when water surrounding thermostatic element reaches 188° F.; discharges full capacity at 208° F.; reseats drip-tight automatically when temperature drops to 183° F. Plenty of power to open or close under all conditions.

**Can be located right in service flow.** Something new has been added: a fixture tapping is provided (in addition to usual tank and drain tappings), so service water will pass right over the temperature element (see installation diagram). This assures immediate response to temperature changes; eliminates air pockets in valve; often cuts piping costs.

**Free flowing waterways:** Provides generous clearances to prevent clogging.

**Big heat dissipating capacity:** A tested, rated, and listed on name for heat input of 1,200,000 B

**McDonnell quality:** All parts are actually in contact with w non-ferrous metals. Valve newest development in sili

* The A G A capacity rating is water discharge because the operation of a temperature necessarily assumes adequate replacement. Note, however, that reason water supply fails, temp pressure can continue to climb the No. 201. Therefore a fea safety suggests the use of an A relief valve rated in *steam* dis ity, such as the McDonnell B Btu-rated Safety Relief Valves to the No. 201.

*Your Jobber Stocks Them*